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DEVELOPMENT OF VOST SAMPLE ANALYSIS PROTOCOL FOR WATER-SOLUBLE VOLATILE POHCs AND PICs

Envirodyne Engineers, Incorporated
St. Louis, MO

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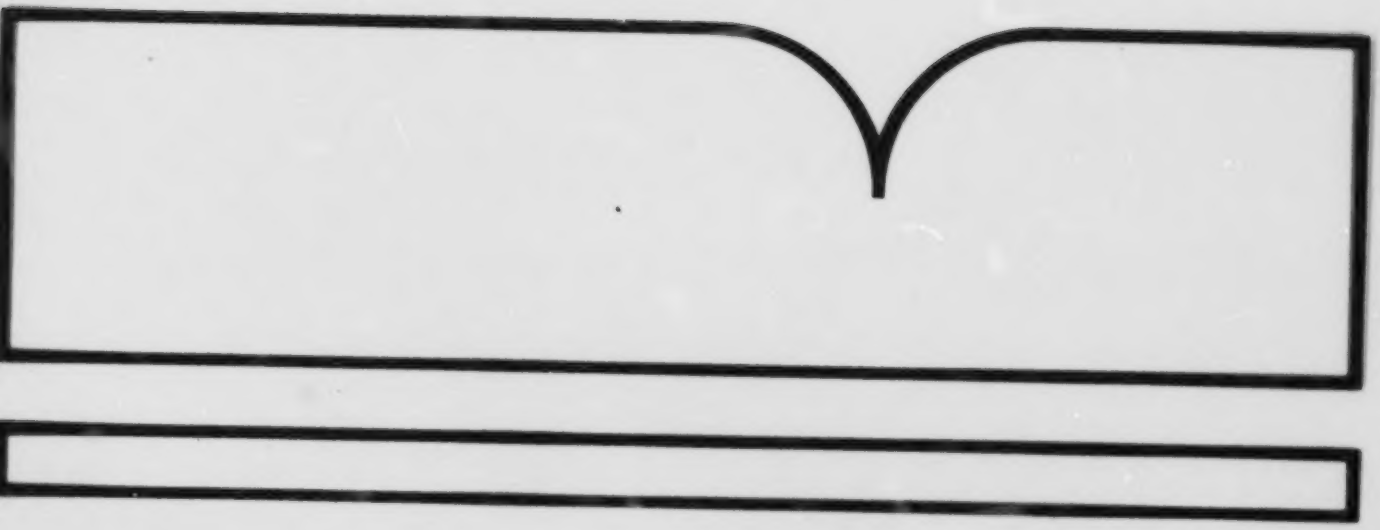

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Development of VOST Sample Analysis Protocol For Water-soluble Volatile POHCs and PICs

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16. ABSTRACT The report gives results of a literature review and laboratory research associated with applying the volatile organic sampling train (VOST) to the sampling and analysis of water-soluble, volatile, principal organic hazardous constituents (POHCs) and products of incomplete combustion (PICs). The POHCs and PICs studied were acetaldehyde, acetone, acetonitrile, acrolein, acrylonitrile, 1,4-dioxane, ethyl acetate, methyl ethyl ketone, methyl formate, propionitrile, propylamine, and pyridine. The collection efficiency of each component of the VOST was established for each compound. The accuracy of current analytical methods for analysis of volatile POHCs and PICs when applied to volatile, water-soluble POHCs and PICs was determined. New analytical techniques were developed and evaluated against existing methods. An accuracy goal of 60-150% pollutant recovery was set, and an analytical goal of 25% or less relative difference between duplicates was used to validate results. Modifications to the existing method of analysis (EPA Method 624) which were evaluated include elevating the purge temperature from the standard (20°C) to 60°C, adding 1 g of either sodium chloride or sodium sulfate salt to the sample before purging, and a combination of both modifications. These modifications improved purge efficiency by about 100% or more for the compounds analyzed.

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ABSTRACT

This document provides the results of literature review and laboratory research associated with application of the volatile organic sampling train (VOST) to the sampling and analysis of water-soluble, volatile, Principal Organic Hazardous Constituents (POHCs) and Products of Incomplete Combustion (PICs). Previous studies resulted in methods development for analysis of volatile POHCs and PICs, but did not address compounds soluble in water.

The specific water-soluble, volatile POHCs and PICs selected for study were: acetaldehyde, acetone, acetonitrile, acrolein, acrylonitrile, 1,4-dioxane, ethyl acetate, methyl ethyl ketone, methyl formate, propionitrile, propylamine, and pyridine. The collection efficiency of each component of the VOST was established for each compound. The accuracy of current analytical methods for analysis of volatile POHCs anc PICs when applied to volatile, water-soluble POHCs and PICs was determined. New analytical techniques were developed through literature search and experimentation, and were evaluated by comparison to existing methods. An accuracy goal of 60 percent to 150 percent pollutant recovery was set, along with an analytical goal of 25 percent or less relative percent difference.

Modifications to the existing method of analysis (purge and trap) include elevating the purge temperature from the standard 20°C to 60°C, adding one gram of either sodium chloride or sodium sulfate salt to the sample before purging, and a combination of both modifications. These modifications improved purge efficiency by approximately 100 percent or greater for the compounds analyzed. Even with the modifications, the highest purge efficiency for 1,4-dioxane was no greater than 21 percent. The resulting purge efficiencies for these compounds ranged from 19.1 percent for 1,4-dioxane to 127 percent for acetaldehyde.

The alternate analytical method of direct aqueous injection into a liquid chromatograph was performed with condensate from the pyridine VOST analysis. VOST recovery of pyridine with this analytical method was at best 23 percent. Other compounds, acrolein, acrylonitrile, 1,4-dioxane, and methyl formate, did not meet the VOST recovery objective of between 60 percent and 150 percent recovery. Pyridine was analyzed by direct aqueous injection on the liquid chromatograph because the purge efficiency was poor and the liquid chromatograph offered a viable alternative.

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ABBREVIATIONS AND SYMBOLS

DRE - Destruction and Removal Efficiency
GC/FID - Gas Chromatograph/Flame Ionization Detector
GC/MS - Gas Chromatograph/Mass Spectrometer
HPLC - High Pressure Liquid Chromatograph
LC - Liquid Chromatograph
PIC - Product of Incomplete Combustion
POHC - Principal Organic Hazardous Constituent
QA/QC - Quality Assurance/Quality Control
RPD - Relative Percent Difference
VOST - Volatile Organic Sampling Train

°C - Degrees Celsius
l - Liter
mg - Milligram
mt/yr - Metric tons/year
NaCl - Sodium chloride
Na_2SO_4 - Sodium sulfate
ng - Nanogram

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DATA QUALITY LIMITATIONS

QA/QC requirements are applicable to this project. The data contained in this report are supported by QA/QC documentation; however, the quality of the data produced did not satisfy the project level Data Quality Objectives (DQOs). Therefore, there are limitations on the possible end uses of the data.

1.0 INTRODUCTION

1.1 BACKGROUND

Sampling and analysis for determination of the concentration of organic pollutants in stack gas effluents presents unique problems due to the minute concentrations involved and the variety of compounds present. Exacting analytical procedures using advanced equipment are required. One of these methods, developed after years of research, is the Volatile Organic Sampling Train (VOST).

The VOST was developed by the USEPA to sample volatile organic chemical constituents in smoke stacks. One application of VOST is the sampling of gaseous effluent from hazardous waste incinerators. The primary goal of this sampling is to determine the destruction and removal efficiency (DRE) of volatile Principal Organic Hazardous Constituents (POHCs) and Products of Incomplete Combustion (PICs). DRE calculations are used to demonstrate compliance with federal regulations.

A protocol for sampling and analysis of volatile POHCs and PICs with VOST has been developed (1). However, it did not provide guidance for analysis of those volatile POHCs and PICs that are water-soluble. Envirodyne Engineers, Inc. (EEI), under Contract No. 68-02-3697, was requested to evaluate the VOST procedures with regard to water-soluble, volatile POHCs and PICs in order to develop an addendum to the existing VOST sampling and analysis protocol. Beginning in January 1985, and continuing through July 1985, EEI performed literature and laboratory research into the analytical methods associated with the application of the VOST method to water-soluble, volatile POHCs and PICs. The results of that research are presented in this report.

The sample collection media in the VOST include a Tenax trap, a condensate collector, and a Tenax/charcoal trap, as shown in Figure 1-1. The standard method of analysis for a volatile POHC or PIC involves use of a thermal desorption unit, purge and trap apparatus, and a GC/MS. The purge and trap procedure specified in the existing protocol may not be suitable for analysis of some water-soluble, volatile POHCs and PICs. This report presents results of experiments to develop modified methods of analysis for those situations

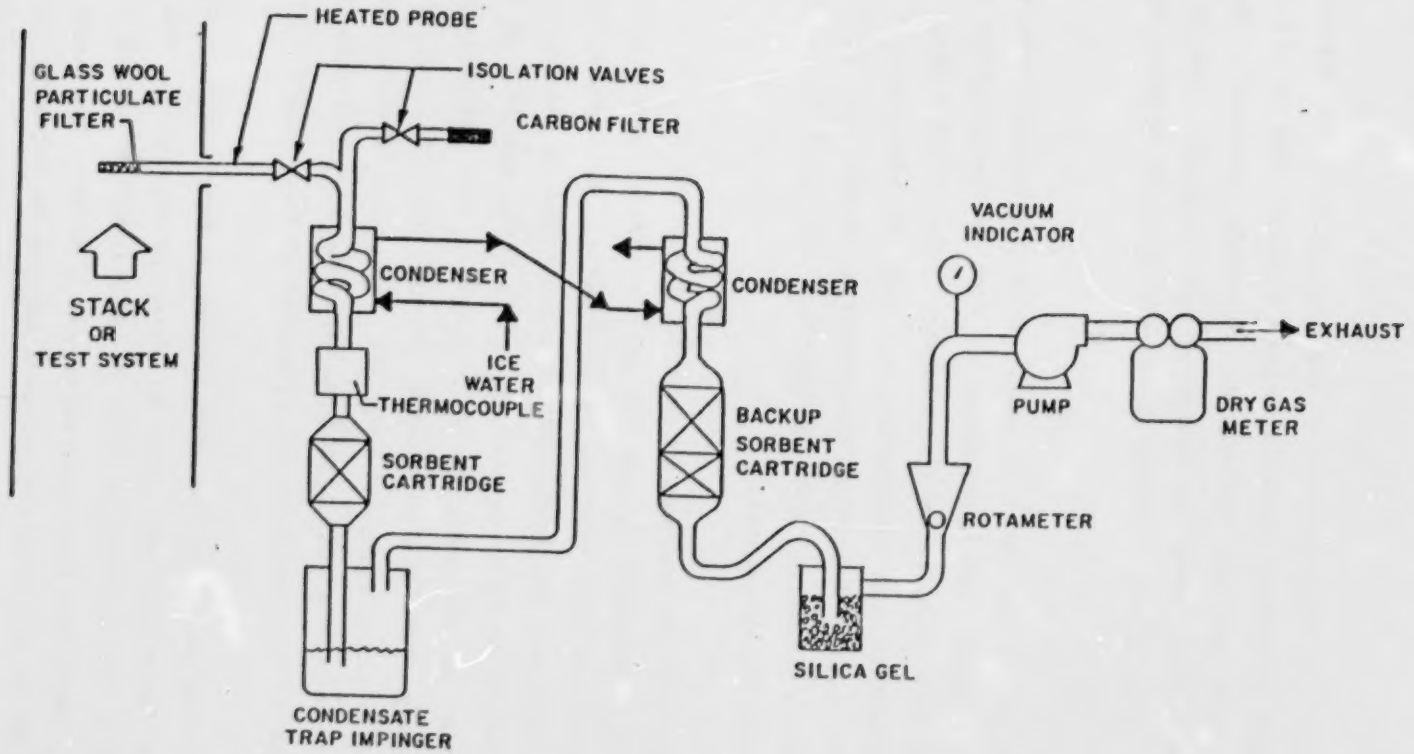

Figure 1-1. Schematic of Volatile Organic Sampling Train (VOST).

in which the VOST may be used to sample water-soluble volatile POHCs and PICs. The specific water-soluble, volatile POHCs and PICs studied are presented in Table 1-1.

1.2 OBJECTIVES

The primary objective of this project was to provide technical information for the development of a protocol for VOST sampling of volatile, water-soluble POHCs and PICs. In order to accomplish the primary objective, four secondary objectives were identified, including:

1) Identification of suitable representative water-soluble compounds for use in methods analysis and development.

2) Determination of the accuracy of current analytical methods for analysis of water-soluble, volatile POHCs and PICs.

3) Development of new analytical techniques through literature search and experimentation, and evaluation of these techniques by comparison to existing methods.

4) Determination of the collection efficiency of each component of the VOST for each compound.

1.3 SCOPE OF WORK

Suitable compounds were identified for study based on criteria developed in the planning phase (see Appendix I). Ten compounds were then evaluated with regard to purge efficiency (see Appendix II, Section 2). Then, modifications and alternatives to the purge and trap method were developed, evaluated, and compared to establish a preferred analytical technique. Finally, VOST experiments were run for selected compounds and recovery efficiencies for each component of the VOST (i.e. Tenax trap 1, condensate, Tenax trap 2, and charcoal trap) were determined using the preferred analytical technique. Although the overall objective of the project included development of modifications to the analytical protocol, it was beyond the scope of the project to develop modifications to the sampling protocol (e.g. substitution for Tenax).

1.4 QUALITY ASSURANCE/QUALITY CONTROL

All laboratory experimentation and analyses were performed in accordance with an ongoing Quality Assurance/Quality Control (QA/QC) program. The QA/QC Plan defined the goals for analytical accuracy and precision, and detailed the procedures necessary for adequate QA/QC.

TABLE 1-1

WATER-SOLUBLE VOLATILE ORGANICS
STUDIED IN THIS PROJECT

Acetaldehyde
Acetone
Acetonitrile
Acrolein
Acrylonitrile
1,4-Dioxane
Ethyl acetate
Methyl ethyl ketone
Methyl formate
Propionitrile
Propylamine
Pyridine

An accuracy goal of 60 percent to 150 percent pollutant recovery was desired, and an analytical precision goal of 25 percent or less relative percent difference (RPD) was set. All analyses were conducted in duplicate. If the RPD exceeded 25 percent, the analyses were repeated. An exception to this criterion is that during evaluation of percent recovery in individual VOST components, the RPD need not be less than 25 percent if the amount of POHC or PIC recovered is less than 10 percent of the total amount present in the influent to the VOST system. For example, in duplicate analyses, recovery values of one percent and four percent in the condensate were acceptable.

Adequate QA/QC was maintained by performance of blank analyses, duplicate analyses, daily calibrations, constant data validation, system maintenance, and corrective action. Each of these QA/QC procedures are explained at length in the QA/QC plan aforementioned.

2.0 SUMMARY AND CONCLUSIONS

The following section presents a summary of the potential modifications to the standard analytical method for analyzing volatile POHCs and PICs, a summary of the results of analysis performed by EEI, and a list of conclusions drawn from evaluation of that analysis.

2.1 ANALYTICAL METHOD MODIFICATION SUMMARY

The standard purge and trap procedure for analyzing volatile POHCs and PICs in VOST impinger condensate was considered potentially inadequate when used to analyze water-soluble volatile POHCs and PICs. Improved analytical techniques were developed and evaluated. Modifications to the standard purge and trap method included elevating purge temperature to 60°C and addition of 1 gram of sodium chloride or sodium sulfate salt to the condensate before purging. An alternative analytical method using direct aqueous injection in a high pressure liquid chromatograph (HPLC) was also investigated.

The basis of comparison between alternate methods was purge efficiency. Purge efficiency was defined as the ratio of the GC/FID curve area response generated by a given quantity of pollutant after purge and trap of the pollutant, to the GC/FID curve area response generated by the same quantity of pollutant after direct aqueous injection into the GC/FID.

The mean purge efficiency for the twelve compounds studied, at room temperature purge without salt addition, was 20.7 percent and ranged from 0.0 percent for pyridine to 44.6 percent for acrolein. The mean purge efficiency using alternate optimal methods was more than 3.7 times greater. The purge and trap procedure with and without modifications is presented in Section 4.

2.2 ANALYTICAL RESULTS SUMMARY

The highest recovery efficiencies achieved for each POHC or PIC evaluated using the VOST are presented in Table 2-1. These recovery efficiencies are the cumulative pollutant recoveries achieved through the combined collection in all components of the VOST system (first Tenax trap, condensate impinger, second Tenax/charcoal trap), divided by the standard weight used in the VOST run. The recovery values reported were the highest cumulative recoveries demonstrated through a series of three runs for each compound, using standard (unmodified) VOST analytical protocol.

TABLE 2-1

HIGHEST RECOVERIES DEMONSTRATED FOR EACH COMPOUND USING STANDARD (UNMODIFIED) VOST ANALYTICAL PROTOCOL[a]

Compound	VOST Recovery (%)
acetaldehyde	83.4
acetonitrile	35.7
acrolein	41.7
acrylonitrile	66.9
1,4-dioxane	34.8
ethyl acetate	99.7
methyl ethyl ketone	87.5
methyl formate	27.8
propionitrile	95.1
pyridine	37.1

[a]These recoveries are blank corrected and represent the cumulative recoveries in all portions of the VOST train (Tenax, condensate and Tenax/charcoal trap). The results reported are the highest of three trials using three different influent weights.

The optimal (closest to 100 percent) recovery efficiencies of each POHC or PIC demonstrated through modified purge and trap procedures for analysis of impinger condensate are presented in Table 2-2. VOST recovery analyses of acetone and propylamine are not presented because of blank contamination. A presentation of more detailed experimental results is in Section 5. The presentation of all experimental results is in Appendix II.

2.3 CONCLUSIONS

1) The VOST protocol for sampling and analysis of volatile POHCs and PICs can be adapted to include the analytical protocol for some volatile, water-soluble POHCs and PICs.

2) In general, analysis of VOST condensates for water-soluble volatiles does not appear to be the limiting factor in determining DRE. The major problem appears to be the inefficient overall recovery and/or poor adsorption/desorption from the Tenax and charcoal sampling traps. Only three compounds (acetaldehyde, 1,4-dioxane and pyridine) had greater than 10 percent of the influent compound to the VOST system captured in the condensate trap.

3) The distribution of the trapped compounds in the various components of the VOST train (first Tenax trap, condensate trap, Tenax portion of the second trap, and charcoal portion of the second trap) is highly variable and appears to be compound-specific. This is demonstrated by the summary of the percentage of the total POHC/PIC collected in each component, as presented in Table 5-2.

4) Purge efficiency of VOST condensate can be greatly enchanced by elevating the purge temperature and by salting the sample with one gram of NaCl or Na_2SO_4 before purging. However, even with these modifications purge efficiency for some compounds, though improved, will still be low.

5) Na_2SO_4 appears to improve purge efficiency to a greater extent than NaCl when used in similar circumstances (i.e. in conjunction with a 60°C purge temperature.)

6) VOST recovery between 60 percent and 150 percent (see Table 2-2 in Section 2.2) were demonstrated using the methods mentioned above for these water-soluble, volatile POHCs and PICs: acetaldehyde, acrylonitrile, ethyl acetate, methyl ethyl ketone, and propionitrile.

7) VOST recovery between 60 percent and 150 percent were not demonstrated even with the methods mentioned above for these water-soluble, volatile POHCs and PICs: acetonitrile, acrolein, 1,4-dioxane, methyl formate, and pyridine.

TABLE 2-2

OPTIMUM PURGE EFFICIENCIES
MODIFIED PURGE AND TRAP TECHNIQUES[a]

Compound	Purge Efficiency (%)
acetaldehyde	109.6
acetone	87.4
acetonitrile	49.3
acrolein	91.8
acrylonitrile	81.0
1,4-dioxane	19.1
ethyl acetate	104.9
methyl ethyl ketone	95.2
methyl formate	93.1
propionitrile	44.7
propylamine	102.8
pyridine	47.1

[a]These results are blank corrected and represent the optimal (closest to 100%) recovery from organic-free water spiked with the compound of interest. Results are the mean of duplicate analysis.

8) For the compounds acetonitrile, acrolein, 1,4-dioxane, methyl formate, and pyridine, a mass balance was not achieved. Recovery of these five compounds was below 45 percent, and the missing mass was not accounted for. Possibly, the compounds were passing through the VOST train without being adsorbed or trapped. More likely is the possibility of poor desorption from the Tenax and/or charcoal in the various traps. For acetonitrile and 1,4-dioxane, the poor purge efficiencies from the condensate offer a significant source of error in the mass balance calculations. Pyridine has been seen to react with the Tenax and be irreversibly bound, thus causing a loss of material from the mass balance.

9) The charcoal trap had a higher recovery percentage than either Tenax trap in the VOST for acetonitrile and methyl formate, which suggests charcoal may be better suited for sampling these compounds.

10) A problem was encountered with the first Tenax trap (the one exposed to the condensate). Uneven wetting of the Tenax (Tenax being hydrophobic) was observed during the experiments. Some of the runs required repetition because of non-reproducible results, either by not duplicating a level with a RPD less than or equal to 25 percent or results between levels not being consistent (e.g. the medium level concentration showing lower recovery than the other levels). Thus, uneven wetting may cause a problem for the water-soluble organics being sampled and must be watched carefully during sampling and analysis. As with any packed trap, the efficiency of packing has a large effect on its performance.

3.0 RECOMMENDATIONS

1) Evaluation of a VOST recovery for a specific water-soluble, volatile POHC or PIC, according to the procedures described in Chapter 4, is recommended before usage in a trial burn for destruction and removal efficiency (DRE) determination, to ensure recoveries within the acceptable range.

2) Examination of the sampling and analysis protocol for VOST is recommended to identify further modifications for those water-soluble POHCs and PICs characterized by either low adsorption or desorption efficiency. This is necessary to ensure the compounds of interest can be analyzed with enough precision to allow the measurement of the necessary DRE levels.

3) Further experiments to complete mass balance evaluations for specific compounds to identify their ultimate fate are recommended.

4) Research into any possible relationship between molecular structure and VOST recovery done by a physical chemist with the goal of developing a method to predict VOST recovery of water-soluble, volatile POHCs and PICs on Tenax resin is recommended.

5) Performing VOST analysis in an organic-free environment is required to eliminate contamination.

6) Direct aqueous injection into a LC of VOST-run condensate is recommended for compounds with poor purge efficiency, adequate ultra-violet absorption, and a large enough injection volume (1 ml) for direct aqueous injection.

7) Modifications to the existing protocol, including addition of one gram of sodium sulfate to the sample and elevation of the purge temperature to 60°C for condensate analysis are recommended.

8) Further investigations to define the optimal salt dosage and purge temperature may result in further improvement to the purge efficiency.

4.0 PROCEDURE

In the following section, a description of the procedure used to achieve the objectives of this project is presented. The procedures used in the project were consistent with the Work Plan, the QA/QC Plan, the EEI QA/QC Handbook for Laboratory Quality Control, and the Protocol for the Collection and Analysis of Volatile POHCs Using VOST.

4.1 PROCEDURES FOR SELECTION OF POHCs AND PICs

Ten water-soluble volatile organic compounds were selected for use in the experiments. These compounds were selected primarily because their solubility in water and/or boiling point were potentially incompatible with the existing VOST protocol. These compounds were also chosen because they represent classes of compounds with similar chemical structure, because of the likelihood of their presence in hazardous waste incinerator feed stocks or emissions, because of their high toxicity and/or because of analytical difficulties reported by other investigators. The sources for candidate POHCs and PICs can be divided into two categories:

1) Organic compounds currently listed in 40 CFR Part 261 Appendix VIII (1) which are soluble in water (arbitrarily, solubility greater than 5 percent) and having a boiling point less than 130°C.

2) Additional organic compounds that satisfy chemical/physical criteria identified above, may be present as products of incomplete combustion in hazardous waste incinerator emissions and are at least moderately toxic, as listed in The Merck Index (2).

The compounds studied are listed in Table 4-1 with the rationale for their inclusion.

4.2 PROCEDURES FOR EVALUATIONS OF PURGE AND TRAP EFFICIENCY

Initially, the efficiency of the purge and trap procedure for each of the compounds identified in Section 4.1 was measured using organic-free water spiked with a known quantity of each compound. The standard conditions listed in EPA Method 624 (3) were observed using a Hewlett-Packard HP-5830A gas chromatograph/flame ionization detector (GC/FID) instead of a gas chromatograph/mass spectrometer (GC/MS). As expected, recovery efficiencies

TABLE 4-1

COMPOUNDS STUDIED IN VOST RECOVERY ANALYSIS

Compound	Boiling Point (°C)	Water Solubility	Rationale for Inclusion
acetaldehyde	21	Miscible	Toxicity
acetonitrile	78	Miscible	Toxicity
acrolein	53	35%	High toxicity
acrylonitrile	82	7.4%	*58,000 mt/yr incinerated
1,4-dioxane	101	Miscible	Toxicity
ethyl acetate	77	10%	*32,000 mt/yr incinerated
methyl ethyl ketone	80	27%	*42,000 mt/yr incinerated
methyl formate	32	30%	Toxicity
propionitrile	97	10%	Toxicity
pyridine	115	Miscible	Toxicity

Source: (References 4 and 5)

*Primary reason for inclusion, compound may also be toxic.

were 45 percent or less in all cases. Additional experiments were designed to modify the purge and trap procedure. A Supelco trap 2-0293 was used with a Nutech Thermal Desorber Model 01 to perform all purge and trap testing.

Modifications to the purge and trap procedure include:

1) Elevation of the temperature of the purging chamber from the standard 20°C to 60°C (6).

2) Addition of 1 gram of sodium chloride salt to the sample prior to purging (6).

3) The combination of 60°C purge temperature and addition of 1 gram of sodium chloride salt (6).

4) The combination of 60°C purge temperature and addition of 1 gram of sodium sulfate salt (7).

Each of these modifications was found to be useful in increasing purge efficiency.

Extended purge time beyond the standard 11.0 ± 0.1 minutes was reported in the literature (8) as a potentially useful method modification, but preliminary experiments with this technique did not result in any significant improvement in purge efficiency, and no further evaluations were conducted.

In all cases, organic-free water generated by an activated carbon treatment system was used for all blanks and standards. A blank was run daily to check the purity of the organic-free water. All standards were prepared by diluting an appropriate amount of each POHC or PIC in water to the working range. All purge and trap experiments were performed in duplicate with a maximum relative percent difference of 25 percent being acceptable for duplication.

The efficiency was calculated by calibrating the GC/FID system using direct injection of the compounds of interest in varying standard concentrations and generating response curves for each compound over the range of concentrations of interest. The calibration curves generated are presented in Appendix I. The calibration curves are only useful with regard to calibration of the GC/FID and the statistical data provided should be used only for that purpose. A summary of this calibration data and the linear regressions of the calibration data are presented in Appendix II.

The purge and trap was then connected to the GC/FID and the standard solution being studied was purged. The purge efficiency was determined by the formula:

$$\text{purge efficiency (\%)} = \frac{\text{purge weight indicated by GC/FID} \times 100}{\text{Standard weight directly injected}}$$

This method of determination of purge efficiency eliminated any error that might have occurred due to possible GC/FID insensitivity to a compound. A description of the analytical equipment and experimental conditions is presented is Table 4-2. The purge and trap apparatus is shown in Figure 4-1.

4.3 PROCEDURE FOR MODIFYING OR REPLACING THE STANDARD PURGE AND TRAP METHOD

The techniques indicated as modifications or alternatives to the purge and trap method were identified through a literature search of technical reference material (9)(10). Alternate procedures were also identified through discussions with the project officer (11), other USEPA contractors (12)(13)-(14) , a resinmanufacturer (15), and USEPA personnel (16)(17). The modifications or alternatives were then evaluated and compared to determine a preferred method. For example, pyridine was analyzed by direct aqueous injection on the LC because the purge efficiency was poor and the LC offered a viable alternative. Pyridine is a sufficient ultra-violet absorber which along with a large enough condensate volume for injection after a VOST run (1 ml), allowed the low detection limit necessary for the direct aqueous injection technique.

4.4 PROCEDURE FOR PERFORMING VOST EXPERIMENTS WITH WATER-SOLUBLE, VOLATILE POHCs AND PICs

The procedure for sample collection with VOST is presented in another publication (19). Samples were collected using equipment that simulated VOST performance and operating conditions, but was simpler to operate. Samples were collected in duplicate using the apparatus depicted in Figure 4-2.

The Tenax and charcoal sample cartridges were prepared by soxhlet extraction for 24 hours with methanol, dried for six hours in a vacuum oven at 50°C, and thermally conditioned by flowing organic-free nitrogen at 30 ml/min through the resin while heating to 250°C for eight hours. The cartridges were stored

TABLE 4-2

PURGE AND TRAP CONDITIONS

Instrument: Tekmar LSC-2

Trap: Supelco trap #2-0294; 1 cm 3% SP-2100, 7.7 cm Tenax, 7.7 cm silica gel 15, 7.7 cm charcoal; Method 601.

Purge Temperature Program: Purge ready @ 35°C (purge 11 minutes); GC oven initially @ 40°C; purge trap desorb, preheat to 100°C desorb final @ 200°C (4 minutes); bake trap @ 225°C (10 minutes)

Carrier Gas: Helium @ 40 ml/minute

Thermal Desporption Chamber: Nutech Thermal Desorber, Model 01

Desorption Chamber Temperature: 200°C

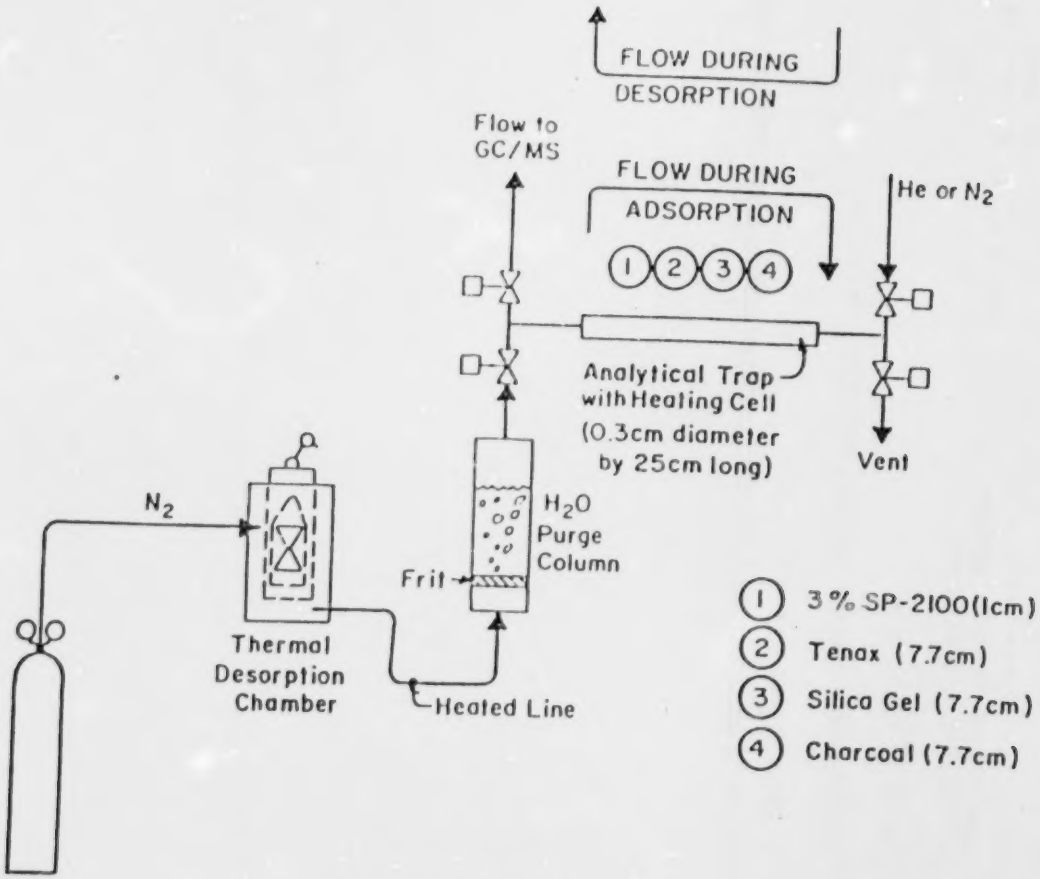

Figure 4-1. Schematic diagram of trap desorption/analysis system.

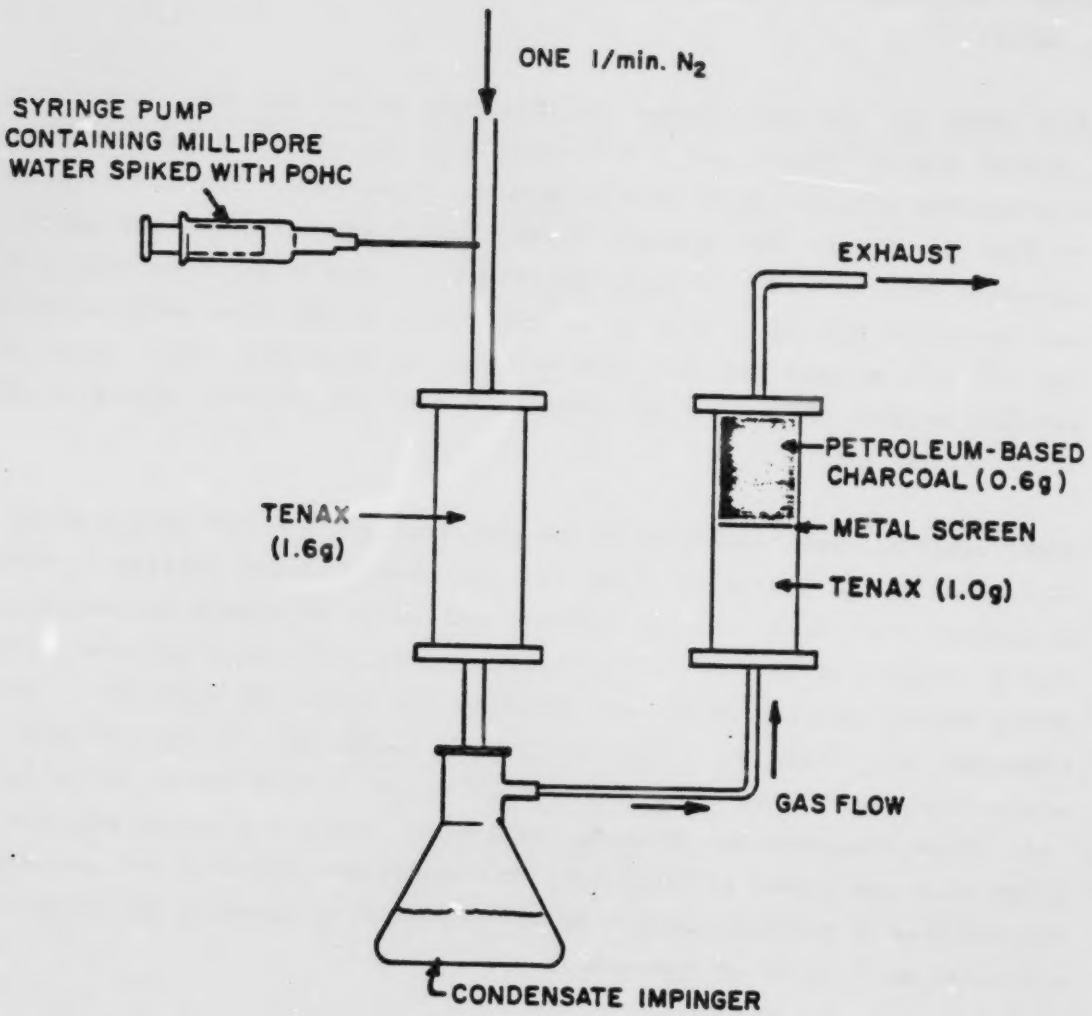

Figure 4-2. Schematic of Sampling Apparatus Used in VOST Recovery Analysis.

for 24 hours at room temperature, then tested for residual organic contamination before sampling for POHCs and PICs. The sorbent cartridges were inside-outside configuration and were thermally desorbed with the carrier gas flowing in the opposite direction of the sample gas flow. The cartridge containing the Tenax and charcoal had an additional stainless-steel screen placed between the Tenax and charcoal. The charcoal was desorbed separately from the Tenax by removing the end screen and emptying the charcoal into an empty trap. The Tenax was desorbed and analyzed separately after the charcoal was removed.

Each POHC or PIC was diluted in Millipore water and then continuously injected for 20 minutes using a syringe pump into a one liter per minute organic-free nitrogen gas stream at ambient temperature. The concentrations of POHC or PIC in the nitrogen stream that passed through the sampling apparatus were 50 ng/l, 100 ng/l, or 150 ng/l. This range of concentrations was considered typical of that to be encountered in hazardous waste incinerator effluent streams and was used by other investigators (18). Thus, the standard weights of POHC or PIC introduced into the sampling apparatus were 1,000, 2,000, and 3,000 ng.

After sampling, each component of the apparatus was analyzed with a HP-5830A GC/FID using the preferred purge and trap method found earlier. GC/FID analytical conditions in VOST recovery and purge efficiency determinations during analysis of acetone, acetonitrile, 1,4-dioxane, ethyl acetate, methyl ethyl ketone, propionitrile, and pyridine are listed in Table 4-3. These compounds are Group A. The analytical conditions during analysis of acetaldehyde, acrolein, acrylonitrile, and methyl formate are listed in Table 4-4. These compounds are Group B. Analytical conditions during analysis of propylamine are listed in Table 4-5. The analytical equipment and conditions for analysis of pyridine using a LC are presented in Appendix II, along with a typical calibration chromatogram.

TABLE 4-3

GC/FID ANALYTICAL CONDITIONS FOR
GROUP A COMPOUNDS

Instrument:	HP-5830A
Detector:	Flame ionization
Column:	1% SP-1000 on Carbopack B 60/80 mesh, 8 feet x 1/8 inch ss
Temperature Program:	40°C (4 minutes) to 210°C at 10°C/minute
Attenuation:	Various
Carrier Gas:	Helium at 40 ml/minute
Flame Gases:	Air at 300 ml/minute, hydrogen at 40 ml/minute
Peak Threshold Limit:	500 area counts

TABLE 4-4

GC/FID ANALYTICAL CONDITIONS FOR
GROUP B COMPOUNDS

Instrument:	HP-5830A
Detector:	Flame ionization
Column:	6 feet x 1/8 inch ss; chromosorb 101 80/100 mesh
Temperature Program:	50°C (2 minutes) to 200°C at 10°C/minute
Attenuation:	64
Carrier Gas:	Helium at 40 ml/minute
Flame Gases:	Hydrogen at 40 ml/minute; air at 300 ml/minute
Peak Threshold Value:	500 area counts

TABLE 4-5

GC/FID ANALYTICAL CONDITIONS
FOR PROPYLAMINE

Instrument: HP-5830A

Detector: Flame Ionization

Column: 4 percent Carbowax 20m + 0.8 percent KOH on Carbopack B 60/80 mesh
6 ft x 1/8 in SS

Temperature Program: 50°C hold 4 min 12°C/min to 220°C

Attenuation: 256

Carrier Gas: Helium at 40 ml/min

Flame Gases: Air at 300 ml/min, hydrogen at 40 ml/min

Area Reject: 250

5.0 RESULTS

5.1 VOST RECOVERY

VOST recovery percentage was calculated by the formula:

$$\text{VOST Recovery (\%)} = \frac{\text{recovered weight} \times 100\%}{\text{standard weight}}$$

The standard weights used were 1,000, 2,000 and 3,000 nanograms of compound. The mean of the duplicate VOST recovery run percentages at each standard weight was calculated for each sampling trap. The sum of the mean VOST recoveries in the sampling train for a given compound is equal to the mean cumulative VOST recovery percentage. A summary of the VOST sampling results is presented in Table 5-1. These are the mean cumulative percent recoveries of the studied POHCs and PICs. These values are blank corrected. The presentation of results of all the VOST runs, both corrected and uncorrected for blank contamination, are contained in Appendix II. Presence of acetone in the organic laboratory as a contaminant caused blanks to exceed the weight levels influent to the system (1000 to 3000 nanograms). Raising influent concentration so that it would exceed the blank contamination would not represent ranges likely to be present in hazardous waste incinerator emissions. Therefore, further experiments with this compound were cancelled and an alternative compound was selected. Propylamine VOST experimentation was halted when it was found that the retention time for this compound is very close to that of acetone and that the GC peaks for propylamine were obscured by the high levels of acetone being detected. A new compound was selected.

The VOST data presented in Appendix II is the result of numerous runs and reruns, and contains only data that is within the statistical limits set in the QA/QC Plan, with two exceptions:

1) The charcoal trap duplicate analysis in the methyl formate VOST run at the 1,000 nanogram level is outside the statistical limits only after blank correction. However, blank contamination was greater than 10 percent of the standard weight and greater than 50 percent of the found weight.

2) The acetaldehyde VOST runs at the 1,000 and 2,000 nanogram level were also outside the statistical limits, due to excessive variation in analysis of the condensate. However, once again, blank contamination was greater than 10 percent of the standard weight and greater than 50 percent of the found weight. Blank contamination could not be avoided with acetaldehyde after numerous reruns due to unavoidable laboratory contamination.

TABLE 5-1

MEAN CUMULATIVE VOST PERCENTAGE RECOVERIES OF VOLATILE WATER-SOLUBLE POHCs AND PICs[a]

Compound	Standard Weight		
	1000 ng	2000 ng	3000 ng
acetaldehyde	83.2	74.4	55.3
acetonitrile	32.2	35.7	33.7
acrolein	41.7	33.9	40.4
acrylonitrile	56.9	66.9	62.6
1,4-dioxane	13.6	34.8	10.4
ethyl acetate	93.8	99.8	91.5
methyl ethyl ketone	87.8	87.7	92.0
methyl formate	27.8	19.5	24.9
propionitrile	95.1	54.3	58.7
pyridine	16.9	34.2	37.1

[a]All values are blank corrected.

Based on the results of the experiments (blank corrected), the first Tenax trap appeared to adsorb more of the acrolein, acrylonitrile, ethyl acetate, methyl ethyl ketone and propionitrile than any of the other components in the VOST train. For acetaldehyde and 1,4-dioxane, a large percentage of the analyte was contained in the condensate, showing apparent breakthrough occurring on the first Tenax trap. From the acetonitrile and methyl formate tests, the majority of the recovered analyte was trapped by the charcoal. One possible explanation for the low overall recovery of the methyl formate may be its low boiling point (31.5°C), meaning the traps were not able to efficiently adsorb the compound. The charcoal trap was probably prevented from absorbing more of the methyl formate by the high humidity it was exposed to. Of the analytes not efficiently adsorbed/desorbed from the first Tenax trap, only acetaldehyde had a total VOST recovery greater than 60 percent. Furthermore, acetaldehyde VOST runs had high blanks, and the difference between the first Tenax trap, the second Tenax trap and the charcoal trap, in terms of average VOST recovery, was only 3 percent, which is not statistically significant.

The average VOST recovery percentage for each trap was calculated by finding the average of all six VOST runs. The percentages represent the average VOST recovery of the pollutant in the 1,000 to 3,000 nanogram range on the specific trap. These numbers are presented in Table 5-2 (not blank corrected) and Table 5-3 (corrected for amounts detected in blanks).

Acetaldehyde VOST recovery shows signs of breakthrough; a constant weight recovery even through the influent weight to the sampling train was increased. However, this may be due to contamination of the sampling train at an even level masking the true recoveries. No other signs of breakthrough were readily apparent for any of the other pollutants.

5.2 PURGE EFFICIENCY

Purge efficiency was calculated by the formula:

$$\text{Purge Efficiency (\%)} = \frac{\text{purged weight} \times 100\%}{\text{standard weight}}$$

TABLE 5-2

PERCENT DISTRIBUTION OF COMPOUNDS
RECOVERED FROM VOST COMPONENTS[a]
NOT BLANK CORRECTED

Compound	First Tenax Trap	Second Tenax Trap	Condensate Trap	Charcoal Trap	Amount Injected
acetaldehyde	35.6% (26%)a	39.7% (29%)	23.4% (17%)	38.7% (28%)	137.4%
acetonitrile	4.4% (11%)	8.7% (22%)	1.4% (4%)	25.5% (63%)	40.0%
acrolein	30.7% (80%)	1.6% (4%)	1.3% (3%)	4.8% (13%)	38.4%
acrylonitrile	46.9% (74%)	7.6% (12%)	1.5% (2%)	7.3% (12%)	63.3%
1,4-dioxane	14.8% (41%)	15.8% (44%)	4.0% (11%)	1.5% (4%)	36.1%
ethyl acetate	95.1% (100%)	0.0% (0%)	0.0% (0%)	0.0% (0%)	95.1%
methyl ethyl ketone	83.5% (84%)	7.2% (7%)	1.4% (1%)	7.4% (8%)	99.5%
methyl formate	8.8% (26%)	4.1% (12%)	0.2% (1%)	20.8% (61%)	33.9%
propionitrile	56.4% (81%)	8.7% (13%)	3.0% (4%)	1.3% (2%)	69.4%
pyridine	10.3% (30%)	8.9% (25%)	11.0% (31%)	5.0% (14%)	35.2%

[a]() Denotes percentage of total recovered material

TABLE 5-3

PERCENT DISTRIBUTION OF COMPOUNDS
RECOVERED FROM VOST COMPONENTS[a]
BLANK CORRECTED

Compound	First Tenax Trap	Second Tenax Trap	Condensate Trap	Charcoal Trap	Amount Injected
acetaldehyde	6.2% (8.7%)	13.8% (19.4%)	35.2% (50.0%)	15.5% (21.9%)	71.0%
acetonitrile	4.4% (12.2%)	3.4% (9.4%)	2.9% (8.0%)	25.5% (70.5%)	
acrolein	30.6% (79.1%)	1.7% (4.4%)	1.6% (4.1%)	4.8% (12.2%)	38.7%
acrylonitrile	45.9% (73.9%)	1.5% (2.4%)	7.5% (12.1%)	7.2% (11.6%)	62.1%
1,4-dioxane	6.8% (34.7%)	3.7% (18.9%)	8.1% (41.3%)	1.0% (5.1%)	19.6%
ethyl acetate	95.0% (100%)	0 0	0 0	0 0	95.5%
methyl ethyl ketone	80.8% (91.2%)	0.8% (0.9%)	7.0% (7.9%)	b 0	88.6%
methyl formate	8.8% (36.5%)	0.2% (0.8%)	4.1% (17.0%)	11.0% (47.5%)	24.1%
propionitrile	43.0% (76.8%)	3.0% (5.4%)	8.7% (15.5%)	1.3% (2.3%)	56.0%
pyridine	6.9% (23.5%)	11.0% (37.4%)	7.4% (25.2%)	4.1% (13.9%)	29.4%

[a]() Denotes percentage of total recovered material
[b]Blank higher than the sample trap value taken as zero.

The standard weight used was 500 nanograms of pollutant. The means of the duplicate purge efficiency determinations using the five different methods are presented in Table 5-4. The presentation of all the purge efficiency determinations both corrected and uncorrected for blank contamination are presented in Appendix II.

The purge efficiency data presented in Appendix II are the results of numerous runs and reruns, and contains only data that are within the statistical limits set in the QA/QC Plan, with one exception. The propylamine purge efficiency duplicates using the room temperature purge salted with NaCl method had a relative percent difference higher than 25 percent. Due to time constrictions a rerun was not performed. It was already determined that raising the purge temperature to 60°C percent and salting with sodium sulfate produced the optimum results with these compounds at the time the problem was discovered and it was believed that time was better spent researching this optimum method than performing a rerun.

The order of most efficient to least efficient method of purge and trap observed is:

1) 60°C purge with addition of 1 gram sodium sulfate
2) 60°C purge with addition of 1 gram sodium chloride
3) 60°C purge
4) Room temperature purge with addition of 1 gram sodium chloride
5) The standard room temperature purge

Modifying the method increased purge efficiency by approximately 100 percent or more in all cases observed.

Although purge efficiency was greatly enhanced, it was still outside the efficiency objective of between 60 and 150 percent for the compounds acetonitrile, 1,4-dioxane, propionitrile and pyridine.

Because pyridine absorbs ultra violet light, the alternate method of direct aqueous injection into a LC was possible for condensate analysis. A typical LC curve for pyridine plus calibration information and experimental conditions are presented in Appendix II. The results of condensate analysis in which 22 percent of the total influent standard was found in the condensate, are also in Appendix II.

TABLE 5-4

MEAN PURGE EFFICIENCIES OF VOLATILE, WATER-SOLUBLE POHCs AND PICs[a]

Compound	Room Temperature (%)	Room Temperature with NaCl (%)	60°C Purge (%)	60°C Purge with NaCl (%)	60°C Purge with Na_2SO_4 (%)
acetaldehyde	33.4	56.0	127.0	109.6	-
acetone	17.4	28.4	49.8	87.4	-
acetonitrile	4.8	18.4	22.0	38.7	49.3
acrolein	44.6	59.2	115.1	91.8	-
acrylonitrile	40.8	-	81.0	-	-
1,4-dioxane	1.6	3.0	6.2	19.1	-
ethyl acetate	34.0	71.2	81.5	106.0	104.9
methyl ethyl ketone	14.0	39.0	56.0	89.3	95.2
methyl formate	42.8	48.0	50.5	93.1	-
propionitrile	6.4	12.8	27.2	44.7	-
propylamine	8.7	22.0	77.3	102.8	-
pyridine	0.0	1.2	4.3	36.0	47.1

[a]Blank corrected.
- = Not determined.

In general, VOST condensate analysis of water-soluble volatiles does not appear to be the limiting step in determining DRE. The problem appears to be inefficient recovery by the Tenax and charcoal sampling traps.

Only three compounds, acetaldehyde, 1,4-dioxane, and pyridine, had greater than 10 percent of the influent analyte to the VOST system captured in the condensate trap, as shown in Table 5-5. Acetaldehyde had a high purge efficiency and all the analyte in the condensate is believed to be detected. Pyridine had a poor purge efficiency, but fortunately pyridine absorbs ultraviolet light well enough that direct aqueous injection into a LC was feasible. The amount detected by LC was only 22 percent of the influent which would again indicate, considering also the VOST recovery of the other traps, a large percentage of the analyte is not being recovered from the Tenax or charcoal traps. 1,4-dioxane had a poor purge efficiency and is not readily analyzed by LC. The literature indicates infrared spectrometry as a viable means of analysis with a detection limit of 20,000 ng/l, which is too high (19). Also, even with 100 percent efficient condensate analysis an estimated 75 percent of the analyte still remains for capture by the other sampling traps.

The maximum amount of compound believed to be in the VOST condensate as shown in Table 5-5, was calculated by dividing the highest amount of compound found in the condensate by the optimum purge efficiency. When this amount is added to the recovery of the other traps, the purge efficiency corrected VOST recovery is produced.

TABLE 5-5

EFFECT OF VOST CONDENSATE ANALYSIS ON VOST RECOVERY COMPUTATION[a]

Compound	Optimum Purge Efficiency[b] (%)	Maximum VOST Condensate Recovery (%)	Condensate Corrected for Purge Efficiency (%)	VOST Recovery Corrected for Purge Efficiency[c] (%)
acetaldehyde	109.6	15.2	13.9	82.1
acetonitrile	49.3	1.9	3.85	37.7
acrolein	91.8	2.0	2.18	41.9
acrylonitrile	81.0	1.6	1.98	67.3
1,4-dioxane	19.1	4.6	24.1	54.3
ethyl acetate	104.9	0.0	0.00	99.7
methyl ethyl ketone	95.2	1.1	1.16	87.6
methyl formate	93.1	0.7	0.75	28.3
propionitrile	44.7	4.2	9.40	100.3
pyridine	47.1	15.9	33.8	55.0

[a]All values blank corrected.
[b]If purge efficiency was greater than 100%, VOST recovery was uncorrected.
[c]Total percent recovery when condensate value is corrected for the purge efficiency.

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(18) K. Vershueren, Handbook of Environmental Data on Organic Chemicals, Second Edition, Van Nostrand Reinhold Company, New York, 1983.

(19) E.M. Hansen, "Protocol for the Collection and Analysis of Volatile POHCs Using VOST," EPA-600/8-84-007, NTIS PB84-170042, March 1984.

APPENDIX I

WATER-SOLUBLE COMPOUNDS IDENTIFIED FOR POSSIBLE EVALUATION

APPENDIX 8* COMPOUNDS

Compound	Water Solubility	Boiling Point (°C)
Acetonitrile	miscible	81.6
Acrolein	33%	53
Acrylamide	67%	125
Acrylonitrile	7.4%	78
Allyl alcohol	miscible	97
Carbon disulfide	0.29%	46
Chloral hydrate	70%	96
Chloroacetaldehyde	soluble	85
Chloromethane	slightly soluble	-24
Chloroform	0.5%	62
Cyanogen	80%	-21
Cyanogen bromide	freely soluble	61
Cyanogen chloride	soluble	13
1,1-Dimethylhydrazine	miscible	63
1,2-Dimethylhydrazine	miscible	81
1,4-Dioxane	miscible	101
Ethylenediamine	miscible	56
Ethylene oxide	soluble	11
Formic acid	miscible	100
Glycidyl aldehyde	miscible	112
Hydrocyanic acid	miscible	25.7
Isobutanol	5%	108
Methyl ethyl ketone	27.5%	80
Methyl hydrazine	miscible	88
Methyl isocyanate	soluble	60
2-Methyl lactonitrile	miscible	95
Paraldehyde	12.5%	124
2-Picoline	miscible	128
Propionitrile	12%	79
2-Propyn-1-ol	miscible	114
Pyridine	miscible	115
n-Propylamine	miscible	48

* 40 C.F.R. Part 261, Appendix VIII

NON-APPENDIX 8* COMPOUNDS
OF INTEREST BECAUSE OF TOXICITY

Compound	Water Solubility	Boiling Point (°C)
High Toxicity:		
Acetaldehyde	miscible	21
Allyl chloride	slightly soluble	45
Allyl cyanide	soluble	119
Isopropylamine	miscible	34
Methacrylonitrile	2.6%	90
Methyl acrylate	6%	70
Methyl formate	33%	32
Morpholine	miscible	106
Nitromethane	9.5%	101
Piperidine	miscible	106
Propionitrile	12%	97
Pyrimidine	soluble	124
Pyrrole	slightly soluble	130
Pyrrolidine	miscible	89
Thiazole	slightly soluble	118
Triethylamine	slightly soluble	90
Trimethylamine	soluble	90
Moderate Toxicity:		
Acetone	miscible	57
n-Butylacetate	0.8%	125
Ethyl acetate	10%	77
Isobutyraldehyde	11%	64
Isopropyl acetate	4%	89
Methyl isobutyl ketone	1.9%	118
n-Propyl acetate	1.6%	102
Tetrahydrofuran	miscible	66
Tetrahydropyran	soluble	88

* 40 C.F.R. Part 261, Appendix VIII

DEFINITION OF TERMS

1) CHEMICAL TOXICITY

a) High Toxicity - The chemical causes a lethal event with exposure of less than 500 mg/70 kg of body weight or upon heating to decomposition it causes the release of toxic fumes.

b) Moderate Toxicity - The chemical does not cause a lethal event with exposure to 500 mg or less, but still may have harmful effects on health

2) SOLUBILITY IN WATER

a) Soluble - A soluble chemical is less than miscible, but greater than 5% soluble in water.

b) Slight Solubility - A slightly soluble chemical is less than 5% soluble in water.

APPENDIX II

CALIBRATION DATA FOR PURGE EFFICIENCY DETERMINATION

TABLE 1

CALIBRATION DATA FOR
PURGE EFFICIENCY DETERMINATION BY GC/FID

Compounds	Amount Injected (ng)									
	25	50	100	150	200	250	300	350	400	500
acetaldehyde	-	-	-	54.4	-	76.7	109	-	-	149
acetone	-	-	21.4	-	-	-	59.8	-	-	113
acetonitrile	-	-	-	-	-	43.6	-	61.2	-	102
acrolein	-	-	18.3	-	-	-	63.4	-	-	105
acrylonitrile	-	-	27.1	-	-	-	79.9	-	-	158
1,4-dioxane	-	8.52	15.6	21.2	-	-	-	-	-	-
ethyl acetate	-	-	-	-	-	28.5	-	39.6	-	65.5
methyl ethyl ketone	-	-	-	-	-	51.1	-	70.9	-	115
methyl formate	-	-	-	-	18.5	-	25.2	-	34.8	42.8
propionitrile	-	-	-	-	69.0	-	94.7	-	118	153
propylamine[a]	-	-	-	-	42.5	-	-	65.5	-	98.3
pyridine (on LC)	3.84	-	14.2	33.5	-	-	-	-	62.0	-
pryidine (P+T)	-	-	-	-	-	-	94.4	-	129	151

NOTE: [a]Propylamine calibrated by peak height in mm.

TABLE 2

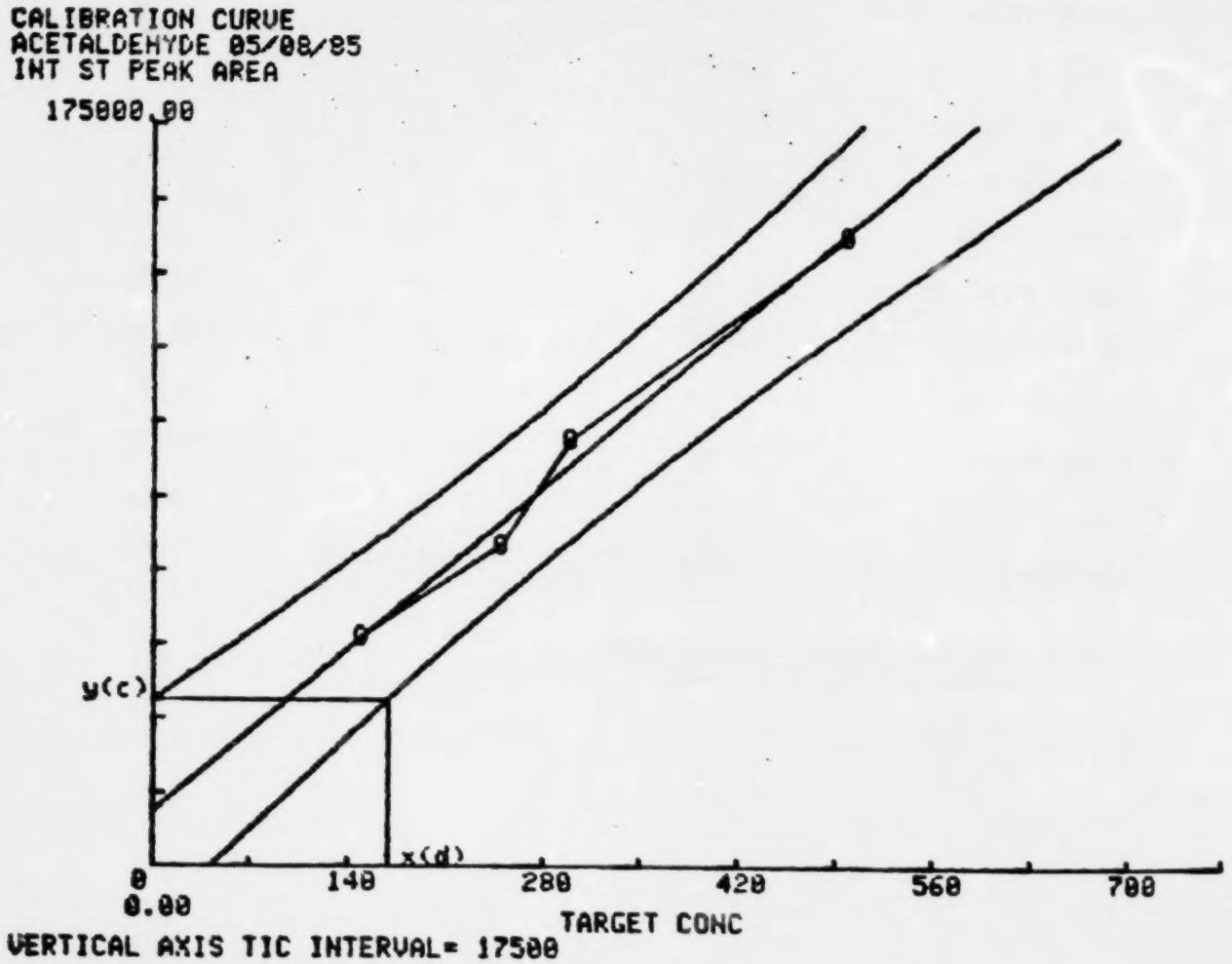
LINEAR REGRESSION DATA
FOR CALIBRATION CURVES

Compound	Correlation Coefficient	Slope (x 102)	Intercept (x 102)
acetaldehyde	0.9938	2.74	129
acetone	0.9957	2.29	3.96
acetonitrile	0.9942	2.35	-173
acrolein	0.9999	2.16	-36.4
acrylonitrile	0.9938	3.28	-98.8
1,4-dioxane	0.9977	1.27	24.4
ethyl acetate	0.9938	1.50	-105
methyl ethyl ketone	0.9955	2.54	-146
methyl formate	0.9980	0.83	14.2
propionitrile	0.9956	2.75	123
propylamine	0.9949	0.01	0.04
pyridinea	0.9966	1.51	22.4
pyridineb	0.9962	3.02	-297

NOTES: aDone on liquid chromatograph
bDone with purge and trap

CALIBRATION CURVE
ACETALDEHYDE 05/08/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
150.000	54420.000
250.000	76160.000
300.000	100800.000
500.000	148800.000



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CALIBRATION CURVE
ACETALDEHYDE 05/08/85
ANALYSIS OF 4 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 300  SD= 147.196014439

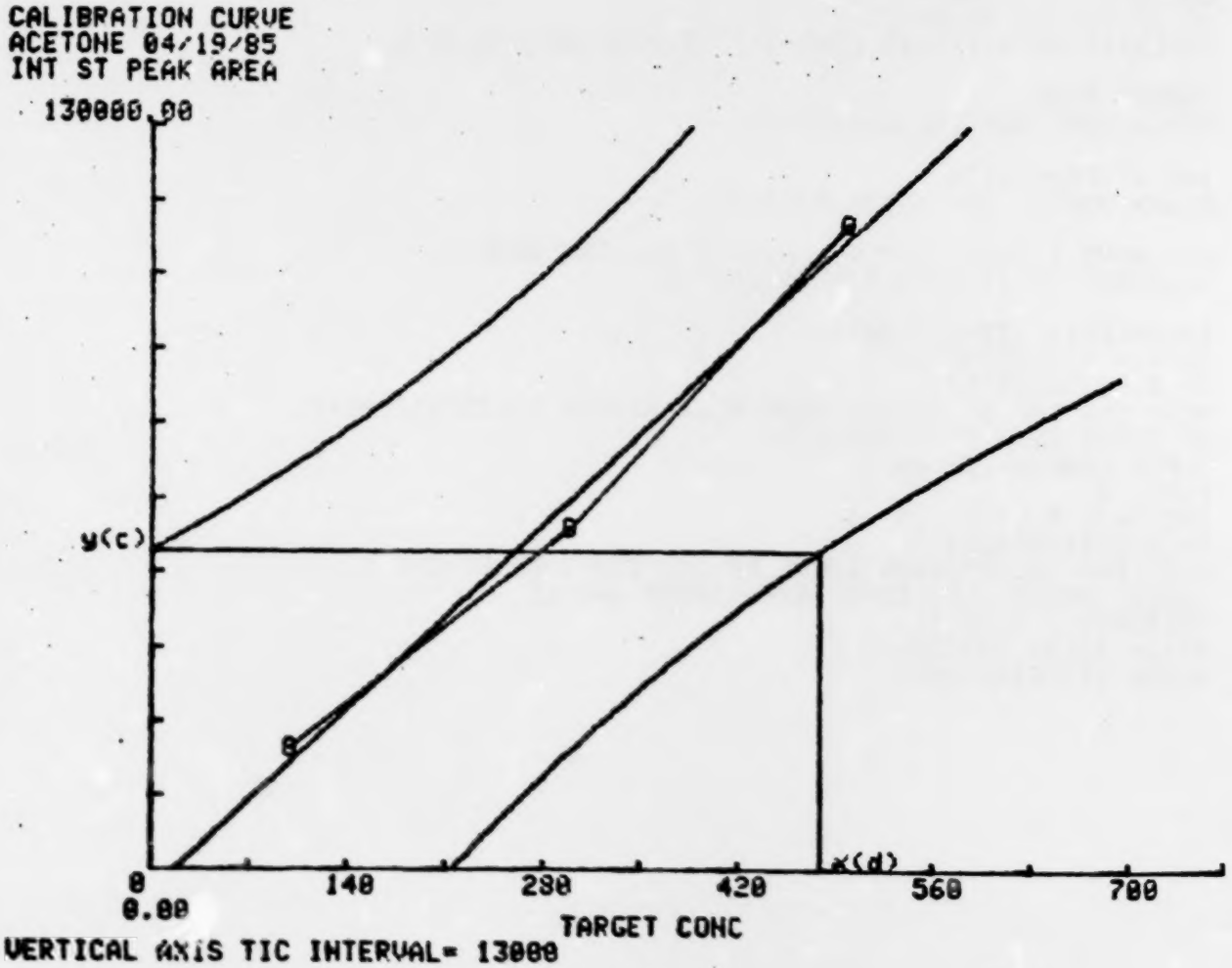
INT ST PEAK AREA
MEAN= 95045  SD= 40537.0361521

NO. RUNS 1 TOTAL X-Y ALL RUNS 4 NO. CONCENTR 4
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= 12941.9230769
SLOPE= 273.676923077
R= 0.993761659575
MEAN SQR DEV OF POINTS FROM REGRESSION= 3.065755769E+7
ST ERROR EST= 5536.92673713
T FOR CONFIDENCE BAND
D.F.= 2
TWO TAIL P LEVEL IS .1
t= 2.91998064954
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 39184.5533799
x(d)= 168.616419851
```

CALIBRATION CURVE
ACETONE 04/19/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
100.000	21380.000
300.000	59770.000
500.000	112900.000



```
CALIBRATION CURVE
ACETONE 04/19/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 300  SD= 200

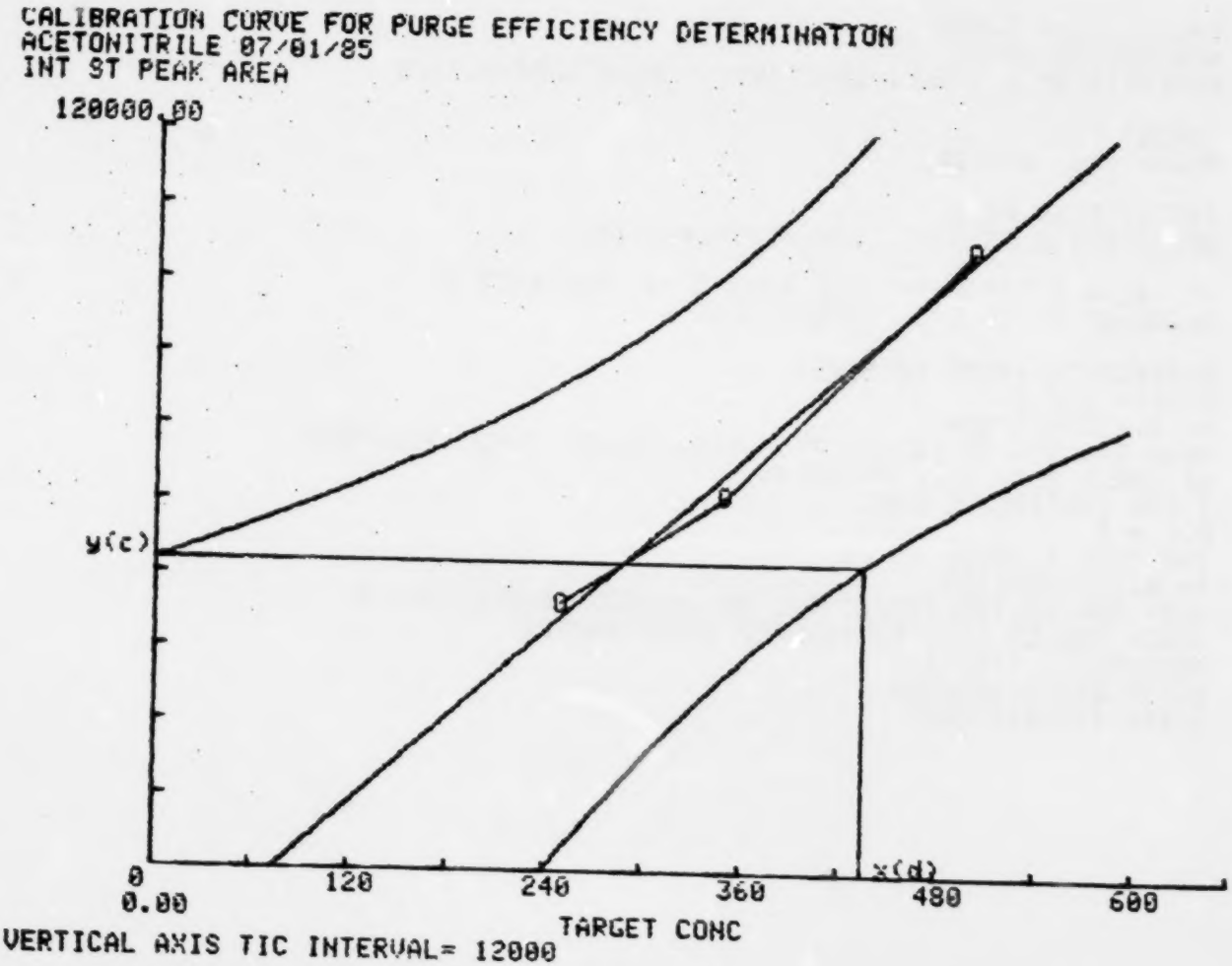
INT ST PEAK AREA
MEAN= 64683.3333333  SD= 45957.4067299

NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= -3956.66666667
SLOPE= 228.8
R= 0.99578457204
MEAN SQR DEV OF POINTS FROM REGRESSION= 3.621126667E+7
ST ERROR EST= 6017.57980145
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 55613.4080589
x(d)= 479.81741804
```

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
ACETONITRILE 07/01/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
250.000	43500.000
350.000	61100.000
500.000	101500.000



```
CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
ACETONITRILE 07/01/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 366.666666667  SD= 125.830573921

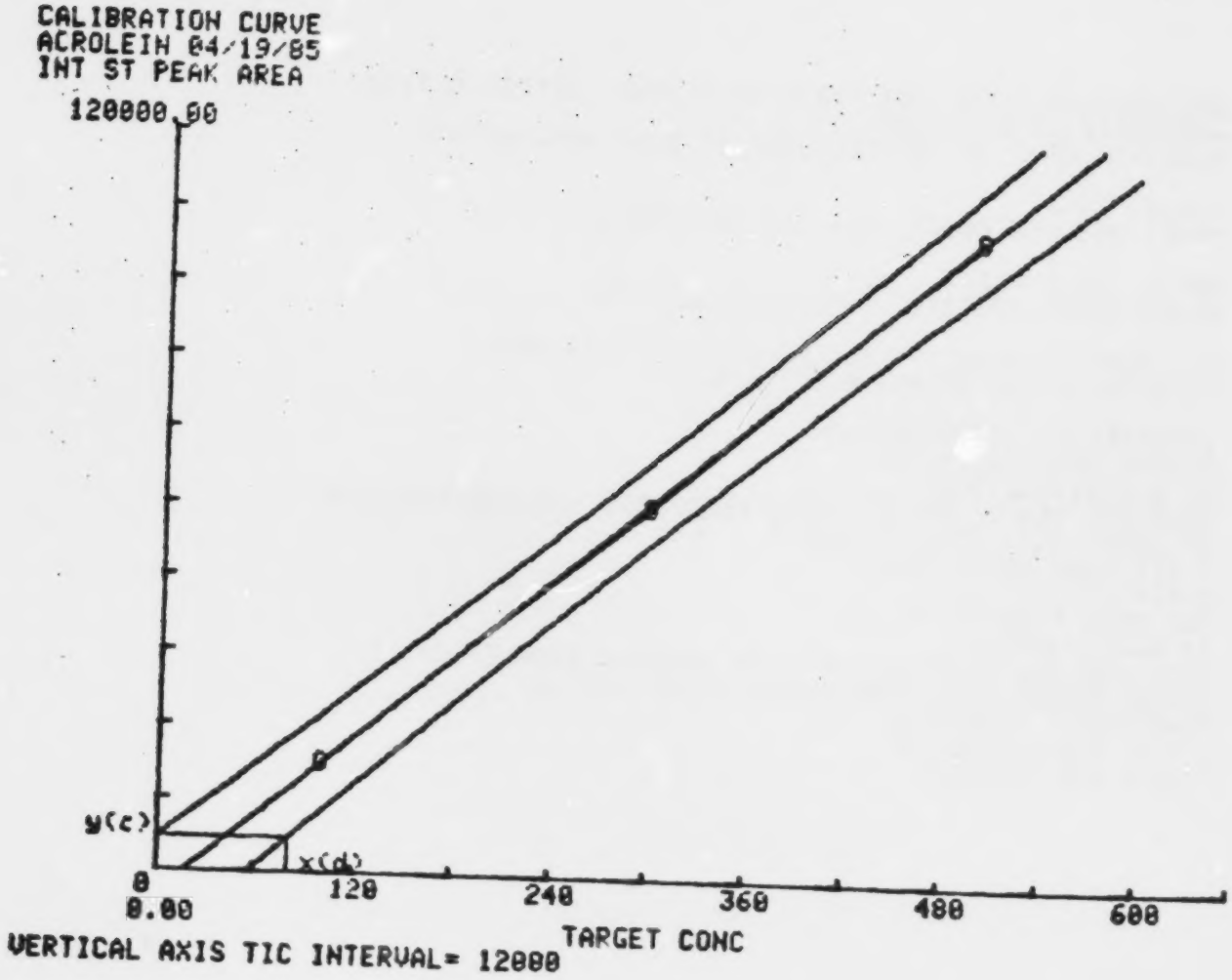
INT ST PEAK AREA
MEAN= 68753.3333333  SD= 29693.4021852

NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= -17270.5263158
SLOPE= 234.610526316
R= 0.994199889596
MEAN SQR DEV OF POINTS FROM REGRESSION= 2.039646316E+7
ST ERROR EST= 4516.24436429
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 50079.7631113
x(d)= 434.96290673
```

CALIBRATION CURVE
ACROLEIN 04/19/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
100.000	18330.000
300.000	60300.000
500.000	104700.000



```
CALIBRATION CURVE
ACROLEIN 04/19/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 300  SD= 200

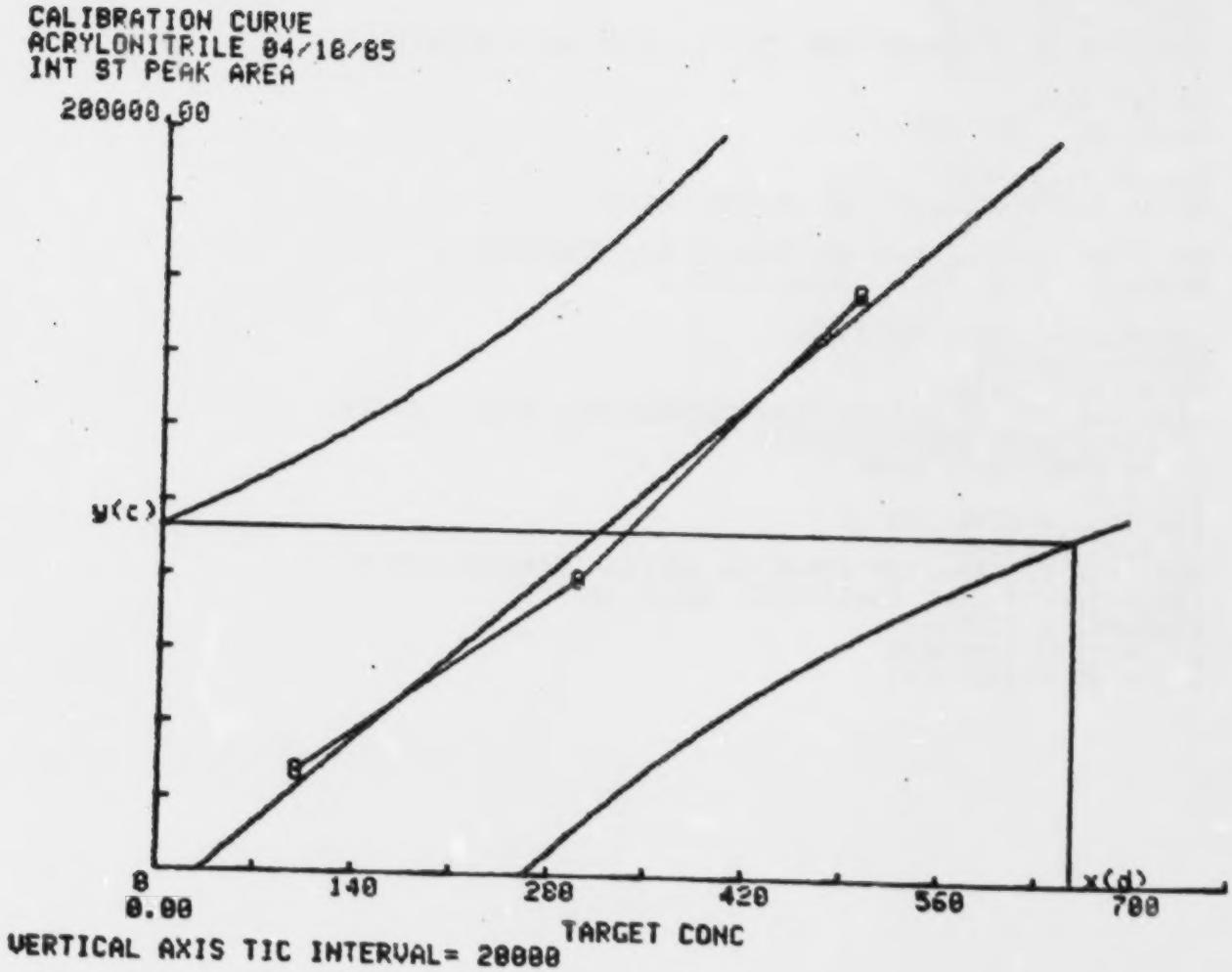
INT ST PEAK AREA
MEAN= 61136.6666667  SD= 43189.971444

NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= -3640.83333333
SLOPE= 215.925
R= 0.999884893557
MEAN SQR DEV OF POINTS FROM REGRESSION= 858816.666748
ST ERROR EST= 926.723619397
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 5533.11983039
x(d)= 80.2825043511
```

CALIBRATION CURVE
ACRYLONITRILE 04/18/85
TARGET CONC, VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
100.000	27130.000
300.000	79940.000
500.000	158200.000



```
CALIBRATION CURVE
ACRYLONITRILE 04/18/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 300  SD= 200

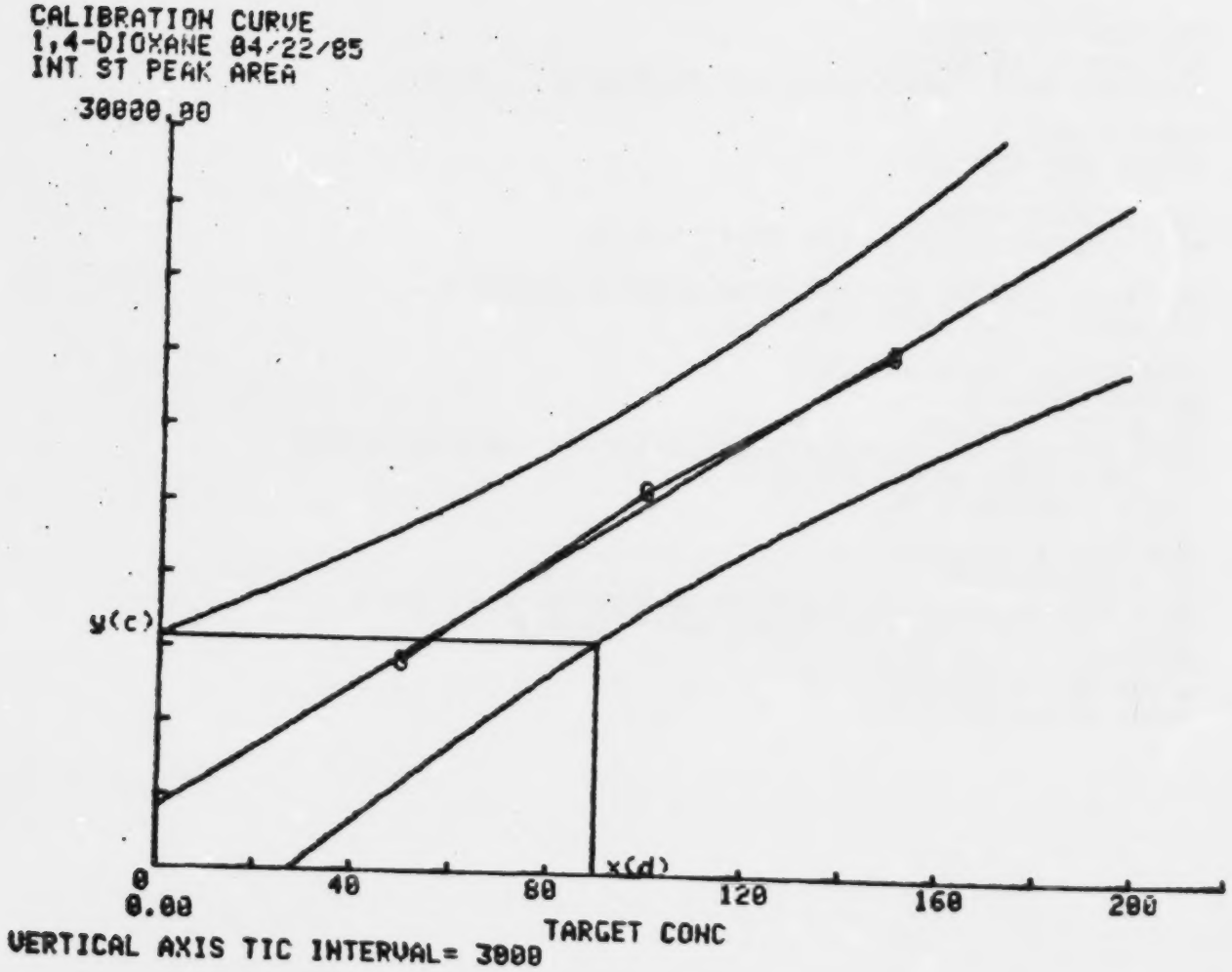
INT ST PEAK AREA
MEAN= 88423.3333333  SD= 65945.5186751

NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= -9879.16666667
SLOPE= 327.675
R= 0.993774881396
MEAN SQR DEV OF POINTS FROM REGRESSION= 1.079504167E+8
ST ERROR EST= 10389.9189923
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 92974.1848778
x(d)= 655.662217143
```

CALIBRATION CURVE
1,4-DIOXANE 04/22/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
50.000	8522.000
100.000	15590.000
150.000	21180.000



```
CALIBRATION CURVE
1,4-DIOXANE 04/22/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 100  SD= 50

INT ST PEAK AREA
MEAN= 15097.3333333  SD= 6343.36514268

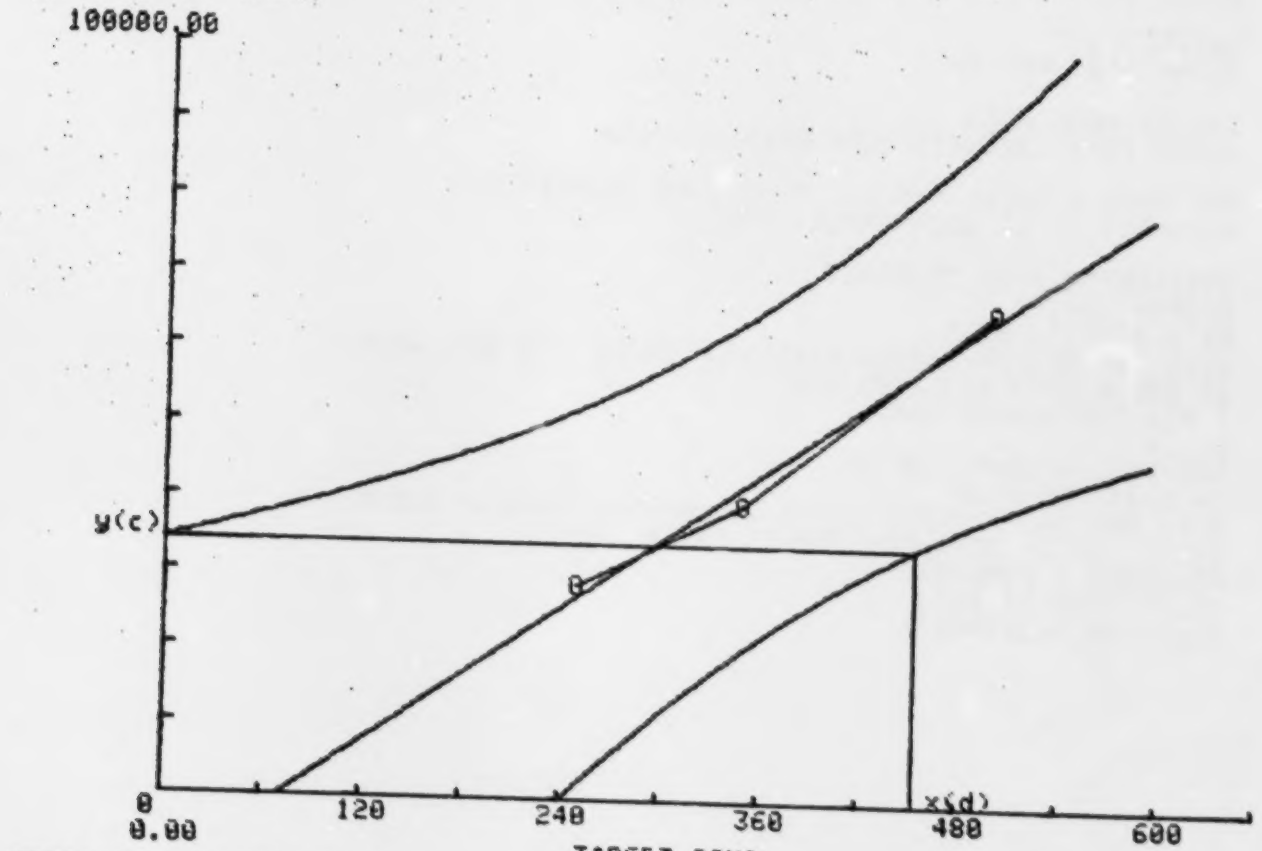
NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= 2439.33333333
SLOPE= 126.58
R= 0.997735486625
MEAN SQR DEV OF POINTS FROM REGRESSION= 364080.666668
ST ERROR EST= 603.390973307
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 9394.7649172
x(d)= 89.9632198331
```

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
ETHYL ACETATE 07/01/85
TARGET CONC, US INT ST PEAK AREA

Target Conc nanograms	Mach Val
250.000	28460.000
350.000	39590.000
500.000	65480.000

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
ETHYL ACETATE 07/01/85
INT ST PEAK AREA



VERTICAL AXIS TIC INTERVAL= 10000

```
CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
ETHYL ACETATE 07/01/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 366.666666667  SD= 125.830573921

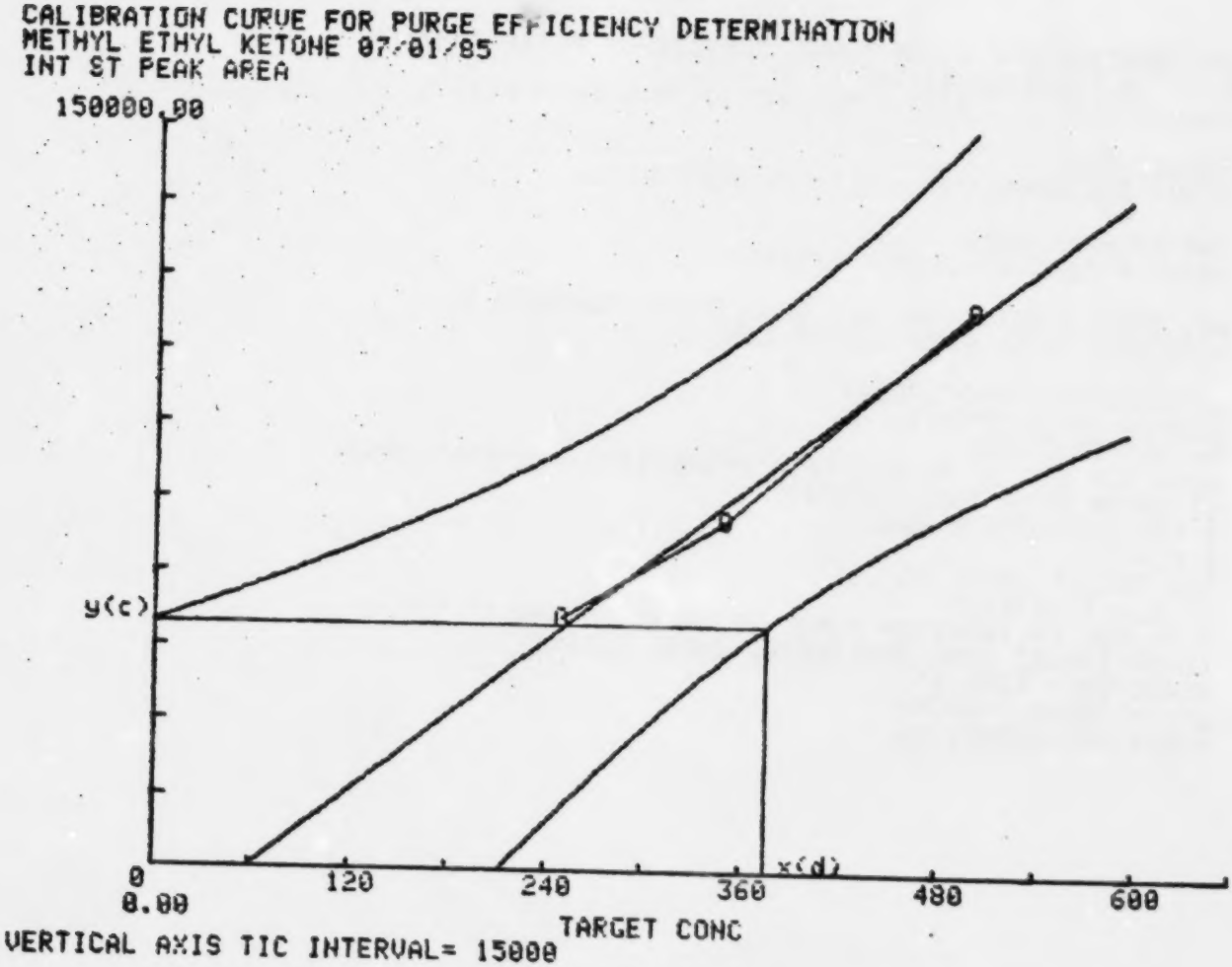
INT ST PEAK AREA
MEAN= 44510  SD= 18994.0753921

NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= -10495.7894737
SLOPE= 150.015789474
R= 0.9938137286
MEAN SQR DEV OF POINTS FROM REGRESSION= 8899792.10524
ST ERROR EST= 2983.25193459
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 33993.1409344
x(d)= 454.128671386
```

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
METHYL ETHYL KETONE 07/01/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
250.000	51080.000
350.000	70940.000
500.000	114000.000



```
CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
METHYL ETHYL KETONE 07/01/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 366.666666667  SD= 125.830573921

INT ST PEAK AREA
MEAN= 78673.3333333  SD= 32164.9643764

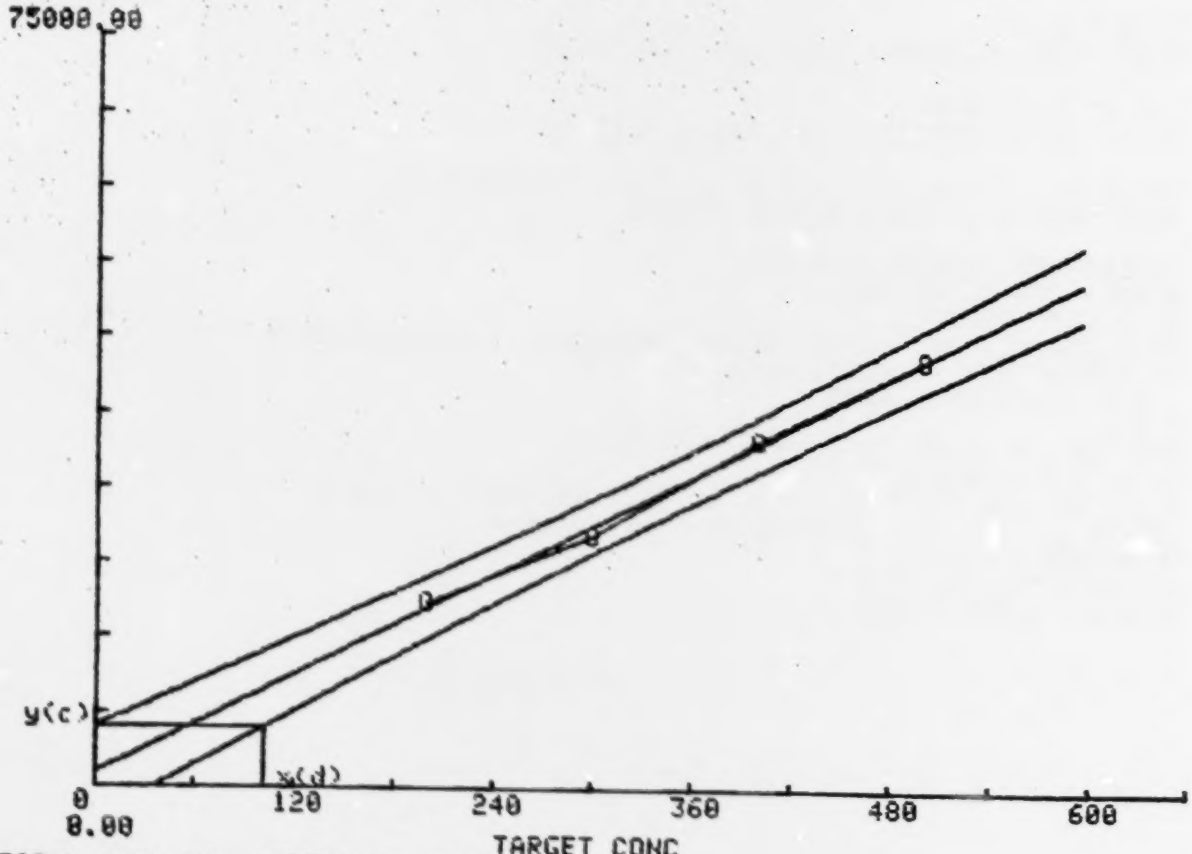
NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= -14633.6842105
SLOPE= 254.473684211
R= 0.995510809754
MEAN SQR DEV OF POINTS FROM REGRESSION= 1.853609474E+7
ST ERROR EST= 4305.35651681
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 49571.6563568
x(d)= 375.772449991
```

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
METHYL FORMATE 06/14/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
200.000	18450.000
300.000	25230.000
400.000	34840.000
500.000	42770.000

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
METHYL FORMATE 06/14/85
INT ST PEAK AREA



VERTICAL AXIS TIC INTERVAL= 7500

```
CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
METHYL FORMATE 06/14/85
ANALYSIS OF 4 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 350  SD= 129.099444874

INT ST PEAK AREA
MEAN= 30322.5  SD= 10680.7907791

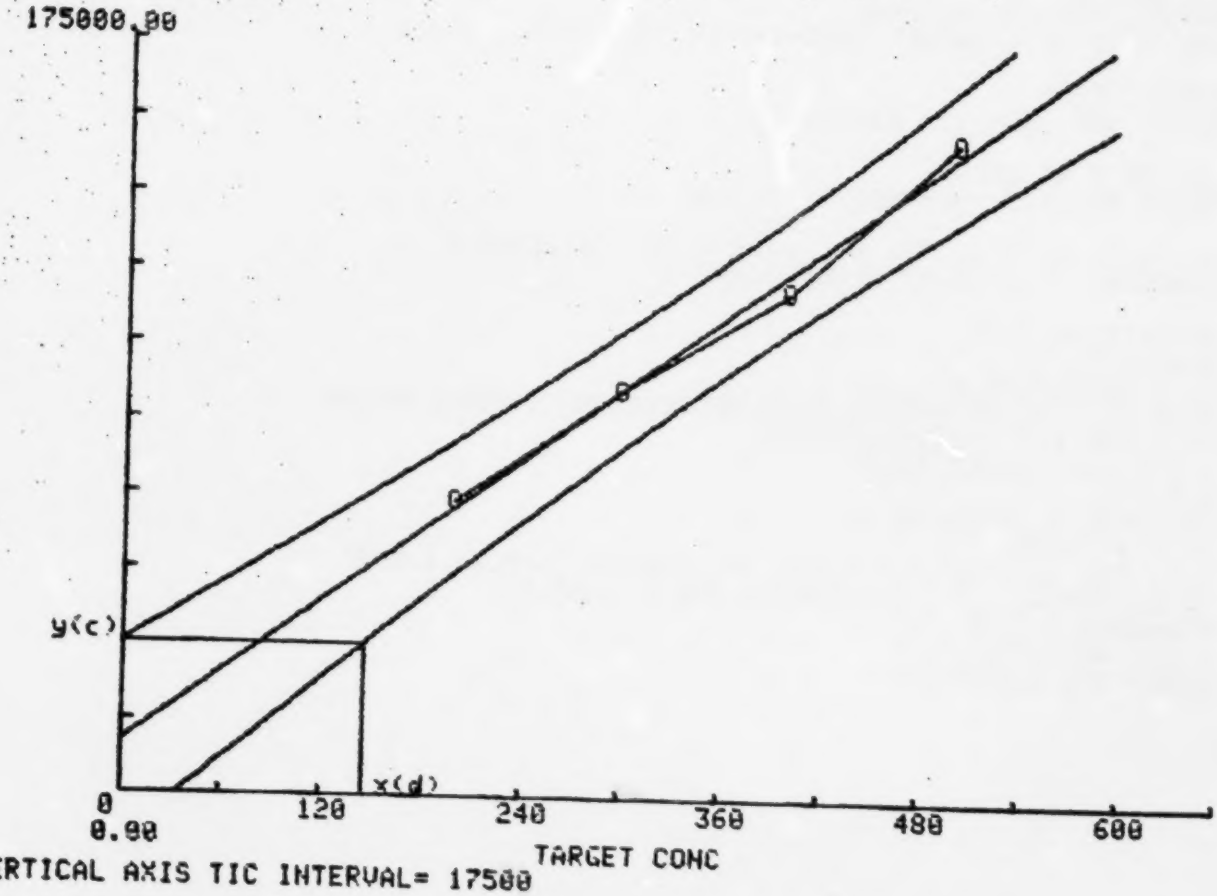
NO. RUNS 1 TOTAL X-Y ALL RUNS 4 NO. CONCENTR 4
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= 1423
SLOPE= 82.57
R= 0.998029208107
MEAN SQR DEV OF POINTS FROM REGRESSION= 673815.000001
ST ERROR EST= 820.862351434
T FOR CONFIDENCE BAND
D.F.= 2
TWO TAIL P LEVEL IS .1
t= 2.91998864954
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 6033.53348314
x(d)= 181.598556259
```

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PROPIONITRILE 06/17/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
200.000	68960.000
300.000	94660.000
400.000	117000.000
500.000	153000.000

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PROPIONITRILE 06/17/85
INT ST PEAK AREA



VERTICAL AXIS TIC INTERVAL= 17500

```
CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PROPIONITRILE 06/17/85
ANALYSIS OF 4 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 350  SD= 129.099444874

INT ST PEAK AREA
MEAN= 108605  SD= 35691.5167325

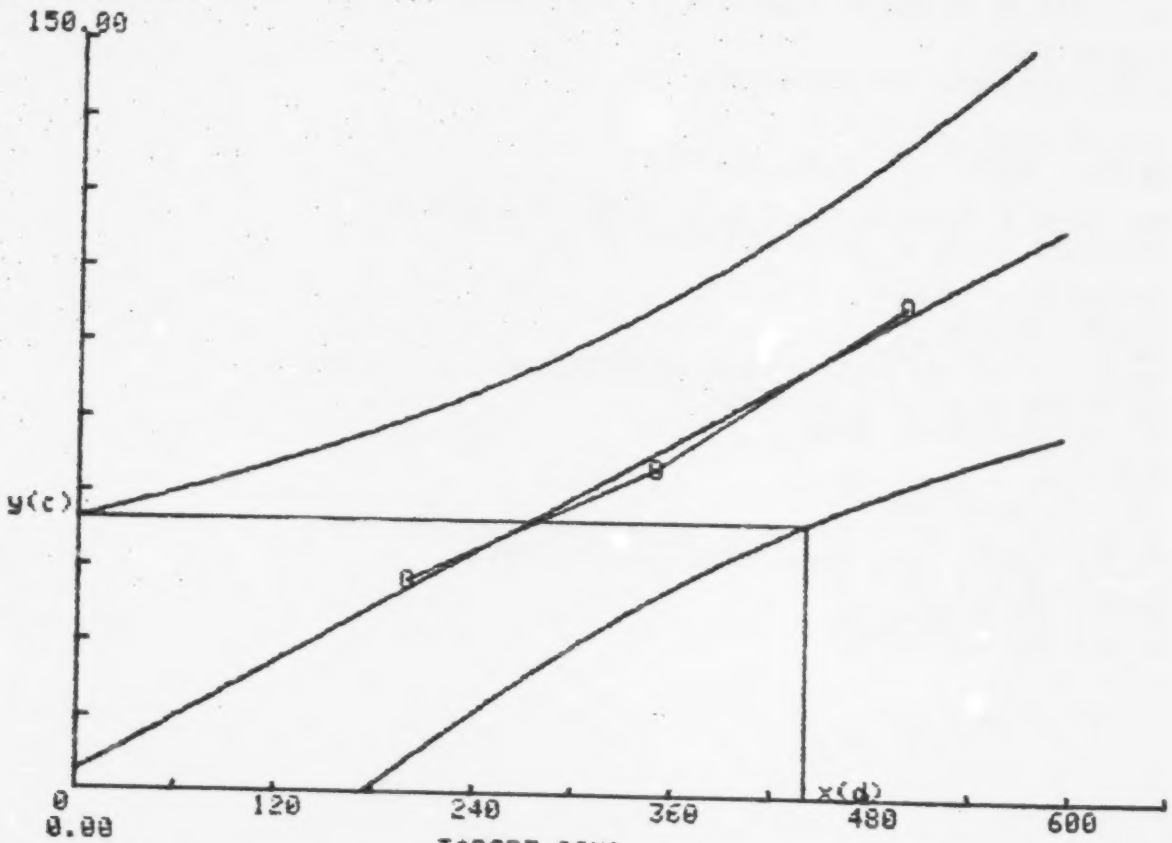
NO. RUNS 1 TOTAL X-Y ALL RUNS 4 NO. CONCENTR 4
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= 12264
SLOPE= 275.26
R= 0.995640321543
MEAN SQR DEV OF POINTS FROM REGRESSION= 1.662486E+7
ST ERROR EST= 4077.35943964
T FOR CONFIDENCE BAND
D.F.= 2
TWO TAIL P LEVEL IS .1
t= 2.91999864954
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 35165.2840706
x(d)= 145.655923701
```

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PROPYLAMINE 05/29/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
200.000	42.500
350.000	65.500
500.000	98.300

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PROPYLAMINE 05/29/85
INT ST PEAK AREA



VERTICAL AXIS TIC INTERVAL= 15

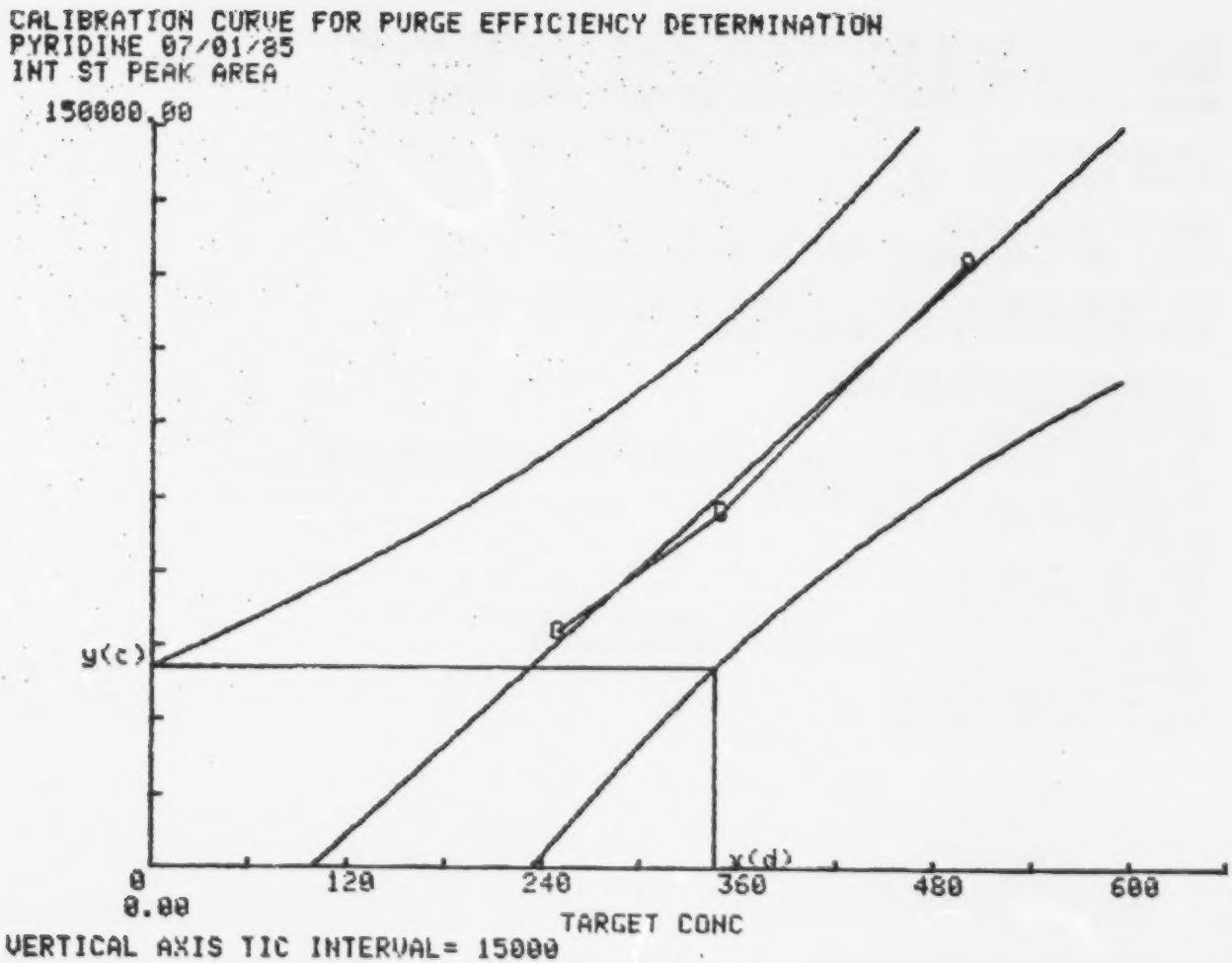
```
CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PROPYLAMINE 05/29/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 350  SD= 150

INT ST PEAK AREA
MEAN= 68.7666666667  SD= 28.0430621248

NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= 3.66666666667
SLOPE= 0.186
R= 0.994899484191
MEAN SQR DEV OF POINTS FROM REGRESSION= 16.0066666668
ST ERROR EST= 4.00083324656
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.31372848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 54.5366422992
x(d)= 440.723558112
```


CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PYRIDINE 07/01/85
INT ST PEAK AREA
150000.00
y(c)
0
0.00
120
240
360
480
600
x(d)
TARGET CONC
VERTICAL AXIS TIC INTERVAL= 15000

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PYRIDINE 07/01/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
250.000	48060.000
350.000	72160.000
500.000	122800.000

CALIBRATION CURVE FOR PURGE EFFICIENCY DETERMINATION
PYRIDINE 07/01/85
ANALYSIS OF 3 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 366.666666667 SD= 125.830573921

INT ST PEAK AREA
MEAN= 81006.6666667 SD= 38147.2742582

NO. RUNS 1 TOTAL X-Y ALL RUNS 3 NO. CONCENTR 3
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= -29730.5263158
SLOPE= 302.010526316
R= 0.996195890676
MEAN SQR DEV OF POINTS FROM REGRESSION= 2.210106316E+7
ST ERROR EST= 4701.17678437
T FOR CONFIDENCE BAND
D.F.= 1
TWO TAIL P LEVEL IS .1
t= 6.3137848485
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 40377.6413421
x(d)= 346.185828252

APPENDIX III

EXPERIMENTAL RESULTS

	Page
Section 1 - Evaluation of VOST Recovery Experimental Results	III-2
Section 2 - Purge Efficiency Determination Experimental Results	III-13
Section 3 - Direct Aqueous Injection of Pyridine VOST Condensate Into a Liquid Chromatograph	III-26

SECTION 1

EVALUATION OF VOST RECOVERY EXPERIMENTAL RESULTS

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: ACETALDEHYDE
RUN DATE: 5/15/85

FIRST TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
480.0	1000	530	495	6.83	51.25	51.25	50	15	107.69	3.25	3.25
480.0	2000	640	780	19.72	35.50	35.50	160	300	60.87*	11.50	11.50
480.0	3000	660	535	20.92	19.92	19.92	180	55	106.38	3.92	3.92

CONDENSATE

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
158.0	1000	230	344	59.7*	28.70	79.95	72	186	88.37*	12.90	16.15
158.0	2000	373	470	23.01	21.08	56.58	215	312	36.81*	13.18	24.68
158.0	3000	624	606	2.93	20.50	40.42	466	448	3.94	15.23	19.15

SECOND TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
70.0	1000	435	380	13.50	40.75	120.70	365	310	16.54	33.75	49.90
70.0	2000	960	845	12.74	45.13	101.70	890	775	13.81	41.63	66.30
70.0	3000	960	1050	8.96	33.50	73.92	890	980	9.63	31.17	50.32

CHARCOAL TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
380.0	1000	680	750	9.79	71.50	192.20	300	370	20.90	33.50	83.40
380.0	2000	510	575	11.98	27.13	128.83	130	195	40.00	8.13	74.43
380.0	3000	519	538	3.60	17.62	91.53	139	158	12.79	4.95	55.27

ND= not detected * = Not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: ACETONITRILE
RUN DATE: 5/3/85

FIRST TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RPD	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
6.0	1000	65	56	14.88	6.05	6.05	59	50	16.51	5.45	5.45
6.0	2000	21	25	17.39	1.15	1.15	15	19	23.53	0.85	0.85
6.0	3000	160	200	22.22	6.00	6.00	154	194	22.99	5.80	5.80

CONDENSATE

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	18	19	5.41	1.85	7.90	18	19	5.41	1.85	7.30
ND	2000	24	26	8.00	1.25	2.40	24	26	8.00	1.25	2.10
ND	3000	28	37	27.69*	1.08	7.08	28	37	27.69*	1.08	6.88

SECOND TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	34	34	0.00	3.40	11.30	34	34	0.00	3.40	10.70
ND	2000	66	68	2.99	3.35	5.75	66	68	2.99	3.35	5.45
ND	3000	62	55	11.97	1.95	9.03	62	55	11.97	1.95	8.83

CHARCOAL TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	230	200	13.95	21.50	32.80	230	200	13.95	21.50	32.20
ND	2000	680	530	24.79	30.25	36.00	680	530	24.79	30.25	35.70
ND	3000	690	800	14.77	24.83	33.87	690	800	14.77	24.83	33.67

ND = not detected * = Not within statistical limits.

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: ACROLEIN
RUN DATE: 5/20/85

FIRST TENAX TRAP

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	320	320	0.00	32.00	32.00	320	320	0.00	32.00	32.00
ND	2000	500	505	1.00	25.13	25.13	500	505	1.00	25.13	25.13
ND	3000	1080	1010	6.70	34.83	34.83	1080	1010	6.70	34.83	34.83

CONDENSATE

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	12	16	28.57	1.40	33.40	12	16	28.57	1.40	33.40
ND	2000	34	31	9.23	1.63	26.75	34	31	9.23	1.63	26.75
ND	3000	44	73	49.57	1.95	36.78	44	73	49.57	1.95	36.78

SECOND TENAX TRAP

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	0	20	200.00	1.00	34.40	ND	20	200.00	1.00	34.40
ND	2000	20	43	73.02	1.58	28.33	20	43	73.02	1.58	28.33
ND	3000	56	68	19.35	2.07	38.85	56	68	19.35	2.07	38.85

CHARCOAL TRAP

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	71	75	5.48	7.30	41.70	71	75	5.48	7.30	41.70
ND	2000	134	89	40.36	5.58	33.90	134	89	40.36	5.58	33.90
ND	3000	0	91	200.00	1.52	40.37	ND	91	200.00	1.52	40.37

ND = Not detected * = not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: ACRYLONITRILE
RUN DATE: 4/22/85

FIRST TENAX TRAP

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	340	360	5.71	35.00	35.00
ND	2000	988	984	0.41	49.30	49.30
ND	3000	1440	1760	20.00	53.33	53.33

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
340	360	5.71	35.00	35.00
988	984	0.41	49.30	49.30
1440	1760	20.00	53.33	53.33

CONDENSATE

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	13	15	14.29	1.40	36.40
ND	2000	23	40	53.97	1.58	50.88
ND	3000	55	43	24.49	1.63	54.97

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
13	15	14.29	1.40	36.40
23	40	53.97	1.58	50.88
55	43	24.49	1.63	54.97

SECOND TENAX TRAP

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	61	48	23.85	5.45	41.85
ND	2000	197	220	11.03	10.43	61.30
ND	3000	230	170	30.00	6.67	61.63

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
61	48	23.85	5.45	41.85
197	220	11.03	10.43	61.30
230	170	30.00	6.67	61.63

CHARCOAL TRAP

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	156	145	7.31	15.05	56.90
ND	2000	71	154	73.78	5.63	66.93
ND	3000	50	10	133.33	1.00	62.63

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
156	145	7.31	15.05	56.90
71	154	73.78	5.63	66.93
50	10	133.33	1.00	62.63

ND = not detected * = not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: 1,4-DIOXANE
RUN DATE: 7/17/85

FIRST TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECVOERY	CUMMULATIVE PERCENT RECOVERY
21.0	1000	68	73	7.09	7.05	7.05	47	52	10.10	4.95	4.95
420.0	2000	660	640	3.08	32.50	32.50	240	220	8.70	11.50	11.50
21.0	3000	147	137	7.04	4.73	4.73	126	116	8.26	4.03	4.03

CONDENSATE

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	24	40	50.00	3.20	10.25	24	40	50.00	3.20	8.15
17.0	2000	84	85	1.18	4.23	36.73	67	68	1.48	3.38	14.88
ND	3000	142	135	5.05	4.62	9.35	142	135	5.05	4.62	8.65

SECOND TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
30.0	1000	62	90	36.84	7.60	17.85	32	60	60.87	4.60	12.75
385.0	2000	760	740	2.67	37.50	74.23	375	355	5.48	18.25	33.13
30.0	3000	65	77	16.90	2.37	11.72	35	47	29.27	1.37	10.02

CHARCOAL TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
9.0	1000	17	18	5.71	1.75	19.60	8	9	11.76	0.85	13.60
26.0	2000	43	77	56.67	3.00	77.23	17	51	100.00	1.70	34.83
9.0	3000	19	23	19.05	0.70	12.42	10	14	33.33	0.40	10.42

ND = not detected * = not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: ETHYL ACETATE
RUN DATE: 4/11/85

FIRST TENAX TRAP

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	980	895	9.07	93.75	93.75
ND	2000	1850	2140	14.54	99.75	99.75
ND	3000	3010	2480	19.31*	91.50	91.50

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
980	895	9.07	93.75	93.75
1850	2140	14.54	99.75	99.75
3010	2480	19.31	91.50	91.50

CONDENSATE

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	ND	ND	0.00	0.00	93.75
ND	2000	ND	ND	0.00	0.00	99.75
ND	3000	ND	ND	0.00	0.00	91.50

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	ND	0.00	0.00	93.75
ND	ND	0.00	0.00	99.75
ND	ND	0.00	0.00	91.50

SECOND TENAX TRAP

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	ND	ND	0.00	0.00	93.75
ND	2000	ND	ND	0.00	0.00	99.75
ND	3000	ND	ND	0.00	0.00	91.50

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	ND	0.00	0.00	93.75
ND	ND	0.00	0.00	99.75
ND	ND	0.00	0.00	91.50

CHARCOAL TRAP

UNCORRECTED FOR BLANK

BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	ND	ND	0.00	0.00	93.75
ND	2000	ND	ND	0.00	0.00	99.75
ND	3000	ND	ND	0.00	0.00	91.50

CORRECTED FOR BLANK

TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	ND	0.00	0.00	93.75
ND	ND	0.00	0.00	99.75
ND	ND	0.00	0.00	91.50

ND = not detected * = not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: METHYL ETHYL KETONE
RUN DATE: 7/2/85

FIRST TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
46.0	1000	840	791	6.01	81.55	81.55	794	745	6.37	76.95	76.95
46.0	2000	1740	1460	17.50	80.00	80.00	1694	1414	18.02	77.70	77.70
22.0	3000	2400	2900	18.87	88.33	88.33	2378	2878	19.03	87.60	87.60

CONDENSATE

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
11.0	1000	23	18	24.39	2.05	83.60	12	7	52.63	0.95	77.90
11.0	2000	16	48	100.00	1.60	81.60	5	37	152.38	1.05	78.75
4.7	3000	22	0	200.00	0.37	88.70	17	ND	200.00	0.28	87.88

SECOND TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	113	84	29.44	9.85	93.45	113	84	29.44	9.85	87.75
ND	2000	70	216	102.10	7.15	88.75	70	216	102.10	7.15	85.90
12.0	3000	240	28	158.21	4.47	93.17	228	16	173.77	4.07	91.95

CHARCOAL TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
125.0	1000	91	96	5.35	9.35	102.80	ND	ND	0.00	0.00	87.75
125.0	2000	200	114	54.78	7.85	96.60	75	ND	200.00	1.75	87.65
454.0	3000	270	21	171.13	4.85	98.02	ND	ND	0.00	0.00	91.95

ND = not detected * = not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: METHYL FORMATE
RUN DATE: 6/25/85

FIRST TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	108	77	33.51	9.25	9.25	108	77	33.51	9.25	9.25
ND	2000	144	130	10.22	6.85	6.85	144	130	10.22	6.85	6.85
ND	3000	395	215	59.02*	10.17	10.17	395	215	59.02*	10.17	10.17

CONDENSATE

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	ND	ND	0.00	0.00	9.25	ND	ND	0.00	0.00	9.25
ND	2000	ND	ND	0.00	0.00	6.85	ND	ND	0.00	0.00	6.85
ND	3000	ND	43	200.00	0.72	10.88	ND	43	200.00	0.72	10.88

SECOND TENAX TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMUALTIVE PERCENT RECOVERY
ND	1000	51	44	14.74	4.75	14.00	51	44	14.74	4.75	14.00
ND	2000	90	80	11.76	4.25	11.10	90	80	11.76	4.25	11.10
ND	3000	86	97	12.02	3.05	13.93	86	97	12.02	3.05	13.93

CHARCOAL TRAP

UNCORRECTED FOR BLANK							CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
160.0	1000	315	280	11.76	29.75	43.75	155	120	25.45	13.75	27.75
160.0	2000	305	350	13.74	16.38	27.48	145	190	26.87	8.38	19.48
160.0	3000	465	510	9.23	16.25	30.18	305	350	13.74	10.92	24.85

ND = not detected * = not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: PROPIONITRILE
RUN DATE: 6/19/85

FIRST TENAX TRAP

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	800	840	4.88	82.00	82.00	800	840	4.88	82.00	82.00
ND	2000	900	790	13.02	42.25	42.25	900	790	13.02	42.25	42.25
ND	3000	1400	1300	7.41	45.00	45.00	1400	1300	7.41	45.00	45.00

CONDENSATE

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	19	22	14.63	2.05	84.05	19	22	14.63	2.05	84.05
ND	2000	49	63	25.00	2.80	45.05	49	63	25.00	2.80	45.05
ND	3000	132	118	11.20	4.17	49.17	132	118	11.20	4.17	49.17

SECOND TENAX TRAP

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	80	90	11.76	8.50	92.55	80	90	11.76	8.50	92.55
ND	2000	150	220	37.84	9.25	54.30	150	220	37.84	9.25	54.30
ND	3000	335	170	65.35	8.42	57.58	335	170	65.35	8.42	57.58

CHARCOAL TRAP

	UNCORRECTED FOR BLANK						CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	24	27	11.76	2.55	95.10	24	27	11.76	2.55	95.10
ND	2000	ND	ND	0.00	0.00	54.30	ND	ND	0.00	0.00	54.30
ND	3000	43	26	49.28	1.15	58.73	43	26	49.28	1.15	58.73

ND = not detected * = not within statistical limits

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC's AND PIC's

COMPOUND: PYRIDINE
DATE: 6/10/85

FIRST TENAX TRAP

		UNCORRECTED FOR BLANK					CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
73.0	1000	30	51	51.85	4.05	4.05	ND	ND	0.00	0.00	0.00
73.0	2000	137	270	65.36*	10.18	10.18	64	197	101.92*	6.53	6.53
73.0	3000	540	462	15.57	16.70	16.70	467	389	18.22	14.27	14.27

CONDENSATE

		UNCORRECTED FOR BLANK					CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
ND	1000	128	74	53.47*	10.10	14.15	128	74	53.47*	10.10	10.10
ND	2000	547	87	145.11*	15.85	26.03	547	87	145.11*	15.85	22.38
ND	3000	209	217	3.76	7.10	23.80	209	217	3.76	7.10	21.37

SECOND TENAX TRAP

		UNCORRECTED FOR BLANK					CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
24.0	1000	42	121	96.93	8.15	22.30	18	97	137.39	5.75	15.85
24.0	2000	163	155	5.03	7.95	33.98	139	131	5.93	6.75	29.13
24.0	3000	450	175	88.00*	10.42	34.22	426	151	95.32*	9.62	30.99

CHARCOAL TRAP

		UNCORRECTED FOR BLANK					CORRECTED FOR BLANK				
BLANK WEIGHT (ng)	STANDARD WEIGHT (ng)	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (ng)	TRIAL 2 WEIGHT (ng)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMMULATIVE PERCENT RECOVERY
15.0	1000	26	24	8.00	2.50	24.80	11	9	20.00	1.00	16.85
15.0	2000	91	143	44.44	5.85	39.83	76	128	50.98	5.10	34.23
15.0	3000	215	182	16.62	6.62	40.83	200	167	17.98	6.12	37.11

ND = not detected * = not within statistical limits

SECTION 2

PURGE EFFICIENCY DETERMINATION EXPERIMENTAL RESULTS

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : ACETALDEHYDE
RUN DATE : 05/08/85

PURGE TEMPERATURE AT AMBIENT LEVEL

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
ND	500	167	167	0.0	33.4	167	167	0.0	33.4

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
ND	500	660	610	7.9	127	660	610	7.9	127.0

ROOM TEMPERATURE AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
5	500	280	290	3.6	57.0	275	285	3.6	56.0

60 DEGREES CELSIUS AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
13	500	560	562	0.4	112	547	549	0.4	109.6

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : ACETONE
RUN DATE : 04/18/85

PURGE TEMPERATURE AT AMBIENT LEVEL

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
30	500	110	124	12.0	23.4	80	94	16.1	17.4

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
52	500	303	299	1.4	60.2	251	247	1.7	49.8

ROOM TEMPERATURE AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
76	500	231	205	12.0	43.6	155	129	18.4	28.4

60 DEGREES CELSIUS AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
78	500	522	508	2.8	103	444	430	3.3	87.4

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : ACETONITRILE
RUN DATE : 07/01/85

PURGE TEMPERATURE AT AMBIENT LEVEL

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	23	25	8.4	4.8	23	25	8.4	4.8

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	110	110	0.0	22.0	110	110	0.0	22.0

ROOM TEMPERATURE AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
18	500	115	105	9.1	22.0	97	87	10.9	18.4

60 DEGREES CELSIUS AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	190	197	3.7	38.8	190	197	3.7	38.7

60 DEGREES CELSIUS AND Na2SO4 SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	253	240	5.3	49.4	253	240	5.3	49.3

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT REQ.

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : ACROLEIN
RUN DATE : 04/19/85

PURGE TEMPERATURE AT AMBIENT LEVEL

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
28	500	250	252	0.8	50.2	222	224	0.9	44.6

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
51	500	627	626	0.2	125	576	575	0.2	115.1

ROOM TEMPERATURE AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
77	500	380	366	3.8	74.6	303	289	4.8	59.2

60 DEGREES CELSIUS AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
79	500	541	535	1.2	108	462	456	1.4	91.8

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : ACRYLONITRILE
RUN DATE : 04/18/85

PURGE TEMPERATURE AT AMBIENT LEVEL

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	202	206	2.0	40.8	202	206	2.0	40.8

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	409	401	2.0	81.0	409	401	2.0	81.0

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : 1,4-DIOXANE
RUN DATE : 04/22/85

PURGE TEMPERATURE AT AMBIENT LEVEL

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	8	8	0.0	1.5	8	8	0.0	1.6

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	30	32	6.5	6.2	30	32	6.5	6.2

ROOM TEMPERATURE AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
4	500	18	20	10.6	3.7	14	16	13.4	3.0

60 DEGREES CELSIUS AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
6	500	97	106	8.9	20.4	91	100	9.5	19.1

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : ETHYL ACETATE
RUN DATE : 07/01/85

PURGE TEMPERATURE AT AMBIENT LEVEL

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanogram)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	170	170	0.0	34.0	170	170	0.0	34.0

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	407	408	0.3	81.6	407	408	0.3	81.5

ROOM TEMPERATURE AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
4	500	350	370	5.6	72.0	346	366	5.7	71.2

60 DEGREES CELSIUS AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	547	513	6.5	106	547	513	6.5	106.0

60 DEGREES CELSIUS AND Na2SO4 SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	537	512	4.8	105	537	512	4.8	104.9

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POTW'S AND PIC'S

COMPOUND : METHYL ETHYL KETONE
RUN DATE : 07/01/85

PURGE TEMPERATURE AT AMBIENT LEVEL

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	70	70	0.0	14.0	70	70	0.0	14.0

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	280	280	0.0	56.0	280	280	0.0	56.0

ROOM TEMPERATURE AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
5	500	200	200	0.0	40.0	195	195	0.0	39.0

60 DEGREES CELSIUS AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	465	428	8.3	89.4	465	428	8.3	89.3

60 DEGREES CELSIUS AND Na2SO4 SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	487	465	4.7	95.2	487	465	4.7	95.2

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : METHYL FORMATE
RUN DATE : 06/14/85

PURGE TEMPERATURE AT AMBIENT LEVEL

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	198	230	15.0	42.8	198	230	15.0	42.8

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	255	250	2.0	50.6	255	250	2.0	50.5

ROOM TEMPERATURE AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	245	235	4.2	48.0	245	235	4.2	48.0

60 DEGREES CELSIUS AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	468	463	1.1	93.2	468	463	1.1	93.1

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : PROPIONITRILE
RUN DATE : 06/17/85

PURGE TEMPERATURE AT AMBIENT LEVEL

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
ND	500	31	33	6.3	6.4	31	33	6.3	6.4

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
ND	500	133	139	4.5	27.2	133	139	4.5	27.2

ROOM TEMPERATURE AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
ND	500	65	63	3.2	12.8	65	63	3.2	12.8

60 DEGREES CELSIUS AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
ND	500	220	227	3.2	44.8	220	227	3.2	44.7

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : PROPYLAMINE
RUN DATE : 05/29/85

PURGE TEMPERATURE AT AMBIENT LEVEL

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
ND	500	46	41	11.5	8.6	46	41	11.5	8.7

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
61	500	445	450	1.2	89.6	384	389	1.3	77.3

ROOM TEMPERATURE AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
46	500	190	122	43.6*	31.2	144	76	61.9*	22.0

60 DEGREES CELSIUS AND NaCl SALTED

BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	UNCORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	UNCORRECTED FOR BLANK: MEAN PERCENT RECOVERY	CORRECTED FOR BLANK: TRIAL 1 WEIGHT (nanograms)	CORRECTED FOR BLANK: TRIAL 2 WEIGHT (nanograms)	CORRECTED FOR BLANK: RELATIVE PERCENT DIFFERENCE	CORRECTED FOR BLANK: MEAN PERCENT RECOVERY
180	500	708	680	4.1	139	528	500	5.5	102.8

* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

CHARACTERIZATION OF PURGE
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : PYRIDINE
RUN DATE : 07/01/85

PURGE TEMPERATURE AT AMBIENT LEVEL

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	ND	ND	0.0	0.0	0	0	0.0	0.0

PURGE TEMPERATURE OF 60 DEGREES CELSIUS

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	21	22	4.7	4.4	21	22	4.7	4.3

ROOM TEMPERATURE AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	6	6	0.0	1.2	6	6	0.0	1.2

60 DEGREES CELSIUS AND NaCl SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	185	175	5.6	36.0	185	175	5.6	36.0

60 DEGREES CELSIUS AND Na2SO4 SALTED

		UNCORRECTED FOR BLANK				CORRECTED FOR BLANK			
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY
ND	500	241	230	4.7	47.2	241	230	4.7	47.1

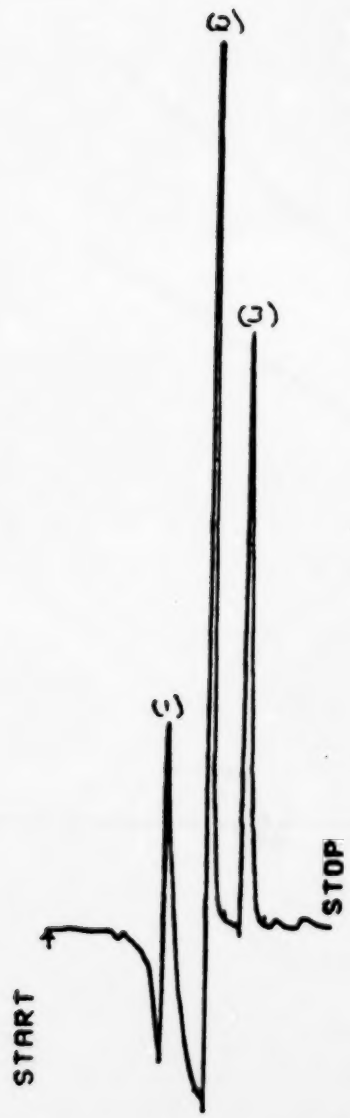
* = NOT WITHIN STATISTICAL LIMIT.
ND = NOT DETECTED NR = NOT RUN

SECTION 3

ANALYSIS FOR PYRIDINE PERFORMED ON AN LIQUID CHROMATOGRAPH

Typical Pyridine Calibration Chromatogram

Chromatographic System: LC-C18
1.0 ml injection volume
UV @ 254 mm attn = 2 ↑ 4
Chart speed 0.5 cm/min.



Conditions:

mobile phase - 35% aqueous CH_3CN containing 0.5 ml nonylaminie per liter.

flow rate - 1.0 ml/min.

column - Spheri-5 RP-18
4.6 mm x 250 mm 5 micron packing

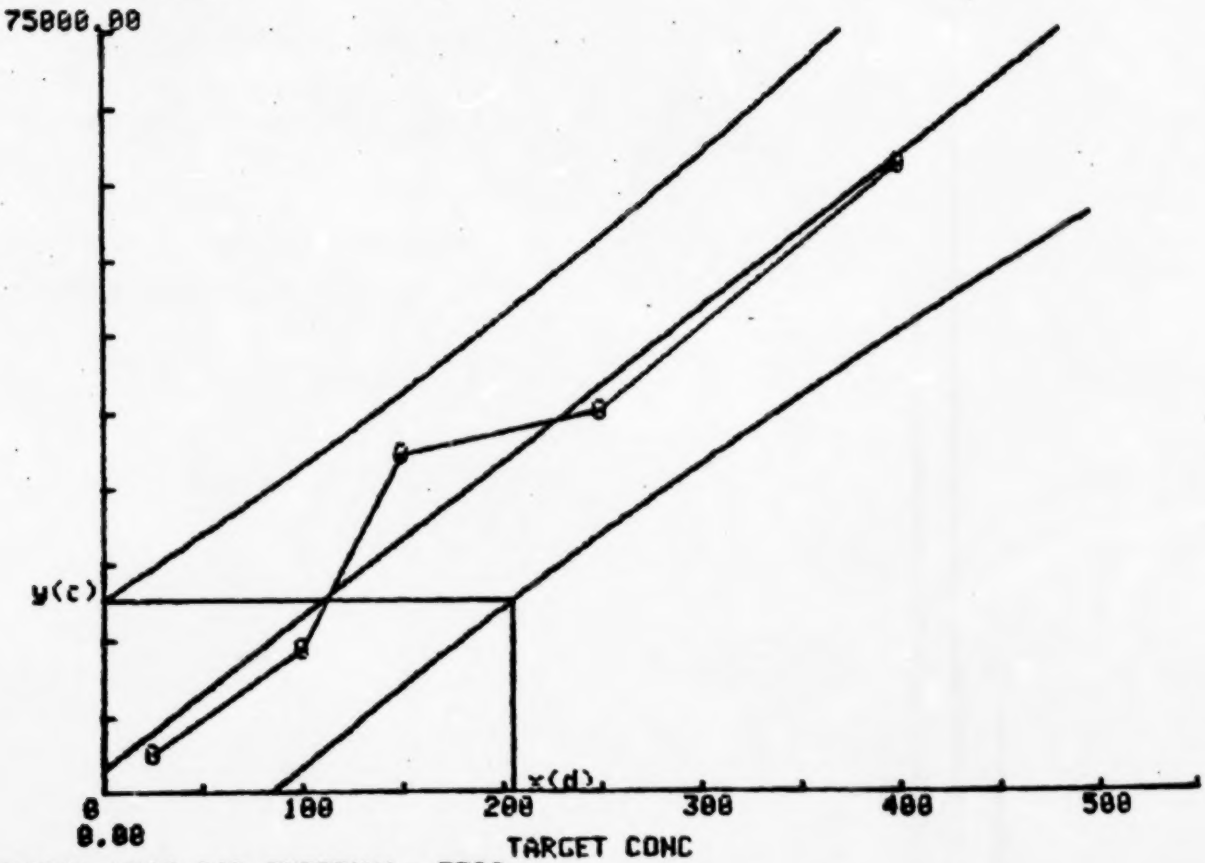
Peak Identification:

1. Baseline disturbance from
2. injection.
3. pyridine

CALIBRATION CURVE
PYRIDINE (Done on LC) 03/15/85
TARGET CONC. VS INT ST PEAK AREA

Target Conc nanograms	Mach Val
25.000	3841.000
100.000	14180.000
150.000	33450.000
250.000	37700.000
400.000	61990.000

CALIBRATION CURVE
PYRIDINE (Done on LC) 03/15/85
INT ST PEAK AREA



VERTICAL AXIS TIC INTERVAL= 7500

```
CALIBRATION CURVE
PYRIDINE (Done on LC) 03/15/85
ANALYSIS OF 5 TARGET CONC-INT ST PEAK AREA POINTS

TARGET CONC
MEAN= 185  SD= 145.344418537

INT ST PEAK AREA
MEAN= 30230.2  SD= 22517.8463713

NO. RUNS 1 TOTAL X-Y ALL RUNS 5 NO. CONCENTR 5
MEASURES (Y'S) EACH TARGET CONC 1

INTERCEPT= 2238.07988166
SLOPE= 151.308757396
R= 0.976642392919
MEAN SQR DEV OF POINTS FROM REGRESSION= 3.121396177E+7
ST ERROR EST= 5586.9456569
T FOR CONFIDENCE BAND
D.F.= 3
TWO TAIL P LEVEL IS .1
t= 2.3533525706
X(D) FOR CALIBRATION CURVE OR UNKNOWN SAMPLE? C/U C
(EACH TARGET CONC CONSIDERED INDEP SAMPLE
MEASURED 1 TIME(S))
y(c)= 18895.3168704
x(d)= 285.473545534
```

EVALUATION OF VOST RECOVERY
EFFICIENCIES FOR POHC'S AND PIC'S

COMPOUND : PYRIDINE
RUN DATE : 03/01/85

CONDENSATE

Pyridine condensate analysis performed on a liquid chromatograph by direct aqueous injection.

		UNCORRECTED FOR BLANK					CORRECTED FOR BLANK				
BLANK WEIGHT (nanograms)	STANDARD WEIGHT (nanograms)	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMULATIVE PERCENT RECOVERY	TRIAL 1 WEIGHT (nanograms)	TRIAL 2 WEIGHT (nanograms)	RELATIVE PERCENT DIFFERENCE	MEAN PERCENT RECOVERY	CUMULATIVE PERCENT RECOVERY
ND	1000	226	231	2.2	22.9	22.9	226	231	2.2	22.9	22.9
ND	2000	228	228	0.0	11.4	11.4	228	228	0.0	11.4	11.4

* = NOT WITHIN STATISTICAL LIMITS.
ND = NOT DETECTED NR = NOT RUN

APPENDIX IV

ADDENDUM TO PROTOCOL FOR THE COLLECTION AND ANALYSIS OF VOLATILE POHCs AND PICs USING VOST: PROCEDURE FOR ANALYSIS OF WATER-SOLUBLE COMPOUNDS

SUMMARY REPORT

ADDENDUM TO PROTOCOL FOR THE COLLECTION AND ANALYSIS OF VOLATILE POHCs USING VOST: PROCEDURE FOR ANALYSIS OF WATER-SOLUBLE COMPOUNDS

By

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Work Assignment 005

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August 1985

ABSTRACT

Application of the VOST methodology for water soluble compounds (solubility greater than 5%) requires a preliminary laboratory evaluation of purge and trap (P&T) procedures, followed by simulated VOST runs, to demonstrate adequate performance for the compound of interest. A modification of the standard P&T procedure, including elevation of the purge temperature to 60°C and addition of one gram of sodium sulfate per 5 ml, is recommended for analysis of VOST condensate. If recovery between 60 percent and 150 percent cannot be demonstrated, additional modifications and alternatives to the P&T procedure are recommended for evaluation.

Results of modifications to P&T procedures to improve recovery efficiency for twelve representative water-soluble organic compounds are reported.

After the best available method for analysis of condensate has been identified, simulated VOST runs should be performed in the laboratory to demonstrate that an overall recovery between 50 percent and 150 percent is achieveable. The method for simulating VOST performance over a range of typical concentrations is described.

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IV-1	Schematic of Sampling Apparatus Used in VOST Recovery Analysis	IV-9

ABBREVIATIONS AND SYMBOLS

DRE - Destruction and Removal Efficiency
GC/MS - Gas Chromatograph/Mass Spectrometer
HPLC - High Pressure Liquid Chromatograph
P&T - Purge and Trap
PIC - Product of Incomplete Combustion
POHC - Principal Organic Hazardous Constituent
RPD - Relative Percent Difference
VOST - Volatile Organic Sampling Train
°C - Degrees Celcius
l - Liter
ml - Milliliter
ng - Nanogram

ACKNOWLEDGEMENTS

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1. INTRODUCTION

Application of the Volatile Organic Sampling Train (VOST) methodology for water-soluble compounds requires a preliminary laboratory evaluation of the collection and recovery efficiency for that compound, prior to field use in a Test Burn. An Addendum to the existing Protocol for the Collection and Analysis of Volatile POHCs Using VOST has been prepared in order to specify methods for analysis of VOST condensate and simulation of VOST performance for compounds of interest.

Laboratory experimentation to evaluate P&T efficiency, modify and test analytical procedures, and evaluate VOST performance was conducted. Compounds studied include acetaldehyde, acetone, acetonitrile, acrolein, acrylonitrile, 1,4-dioxane, ethyl acetate, methyl ethyl ketone, methyl formate, propylamine, propionitrile, and pyridine.

2. CONDENSATE ANALYSIS

Analysis of condensate by GC/MS with a modified P&T routine shall be required for organic compounds whose solubility in water exceeds 5%. The performance of modified P&T procedures, including 60°C purge temperature and addition of one gram sodium sulfate per 5 ml of organic-free water spiked with the water-soluble organic of interest, should be evaluated in the laboratory prior to the Trial Burn. This modification has been demonstrated to improve P&T performance by 100% or greater compared with the standard procedure. Condensate recovery of at least 60% is desirable. If this degree of recovery cannot be demonstrated, further modifications or alternatives are suggested. These include:

1) Further increase in purge temperature.
2) An increase in sodium sulfate dosage.
3) Substitution of sodium chloride for sodium sulfate.
4) Extended purge time beyond 11 minutes.

(These method modifications were not thoroughly evaluated, but may improve P&T performance for individual compounds.) Alternative analytical methods include direct aqueous injection into an HPLC if the compound absorbs ultraviolet light, or infrared spectrometry if the compound absorbs infrared light.

3. VOST SIMULATION

After evaluation of methods for condensate analysis is complete, simulated VOST runs should be performed in the laboratory. The simulation is conducted using the apparatus depicted in Figure IV-1. In a series of runs, a syringe pump containing organic-free water spiked with the water-soluble POHC or PIC of interest at three concentrations spanning the range expected in the flue gas effluent (e.g. 50 to 150 ng/l) is injected into a one liter per minute organic-free nitrogen gas stream for 20 minutes. Each simulation is run in duplicate with a maximum relative percent difference (RPD) of 25% allowed for purpose of validation.

VOST components capturing less than 10% of the total POHC/PIC passing through the train during duplicate runs need not agree within 25%. Results should be corrected for blank contamination. The mean recovery for all six runs must exceed 50% and be less than 150% of the total mass of POHC/PIC entering the system in order to demonstrate that the sampling and analysis methodology is applicable for use in a Trial Burn for determination of Destruction and Removal Efficiency (DRE).

4. ORGANIC CONTAMINATION

Due to the minute concentrations involved and potential for contamination of samples and blanks, procedures described above should be performed in an organic-free room, if available.

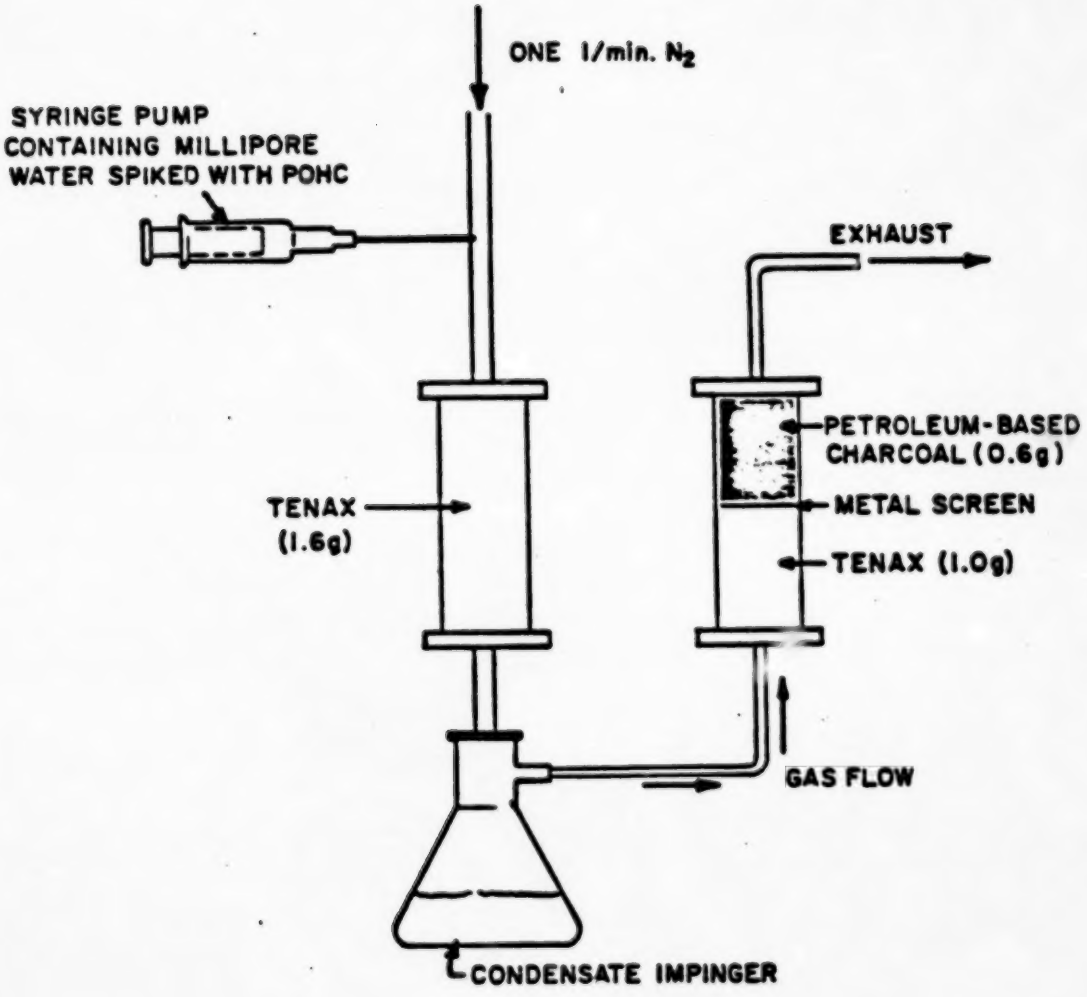

Figure IV-1. Schematic of Sampling Apparatus Used in VOST Recovery Analysis.